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PERMIAN FORAMINIFERA FROM TURKEY

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ABSTRACT

Collections from two thin measured sections of Permian limestone, located 30 to 31 kilometers south-southwest of Ankara, Turkey, contain a rich and varied fauna of Foraminifera, from which 20 species belonging to 12 genera are described here. Of this number, one of the genera and 14 of the species are new; of the remainder, two of the species have been previously described, and four are insufficiently represented to permit definite specific assignments but are included to complete the record. The fauna suggests that the enclosing rocks are rather low in the "Zone of *Yabeina*."

INTRODUCTION

In May, 1958, Dr. JESSE L. DALLY, who at that time was working for Esso Standard (Turkey) Inc. at Ankara, Turkey, sent me a suite of Permian limestone collections containing a rich and varied foraminiferal fauna. These were obtained from localities 30 and 31 kilometers south-southwest of Ankara (Fig. 1) on the west side of the road from Ankara to Haymana where two sections were measured (Fig. 2). The localities are 1 and 2 kilometers, respectively, southwest of the village of Çerkezhüyük. According to DALLY (personal communication) the beds are folded and rather poorly exposed. The stratigraphic relationship between the two sections therefore is uncertain. The fact that certain species are common to both sections, however, suggests that the fossil-bearing strata do not differ greatly in age. The rocks, for the most part, are coffee brown limestone with a moderate amount of calcite veining, and the preservation of the fossils is unusually good. The general aspect of the fauna indicates that the sections belong rather low in the "Zone of *Yabeina*" and are Middle to Upper Permian.

I wish to express my thanks to Dr. DALLY for making this interesting material available to me for study, and to the Humble Oil & Refining Company for permission to publish this paper.

All figured holotypes and paratypes are deposited in the collections of the Paleontological Institute of the University of Kansas, Lawrence, Kansas; all other figured specimens are in the files of the Humble Oil & Refining Company at Midland, Texas.

FUSULINID COLLECTIONS

Collections Tur-4 through Tur-9 were obtained from DALLY's Section 1, located one kilometer southwest of the village of Çerkezhüyük on the west side of the road from Ankara to Haymana.

Tur-4. Permian limestone, 1.5 feet above base of section. Coll. DALLY 2-1767 A.

Tur-5. Permian limestone, 6.5 feet above base of section. Coll. DALLY 2-1768 A.

Tur-6. Permian limestone, 11.0 feet above base of section. Coll. DALLY 2-1769 A.

Tur-7. Permian limestone, 16.0 feet above base of section. Coll. DALLY 2-1770 A.

Tur-8. Permian limestone, 21.0 feet above base of section. Coll. DALLY 2-1771 A.

Tur-9. Permian limestone, 27.0 feet above base of section. Coll. DALLY 2-1771 AA.

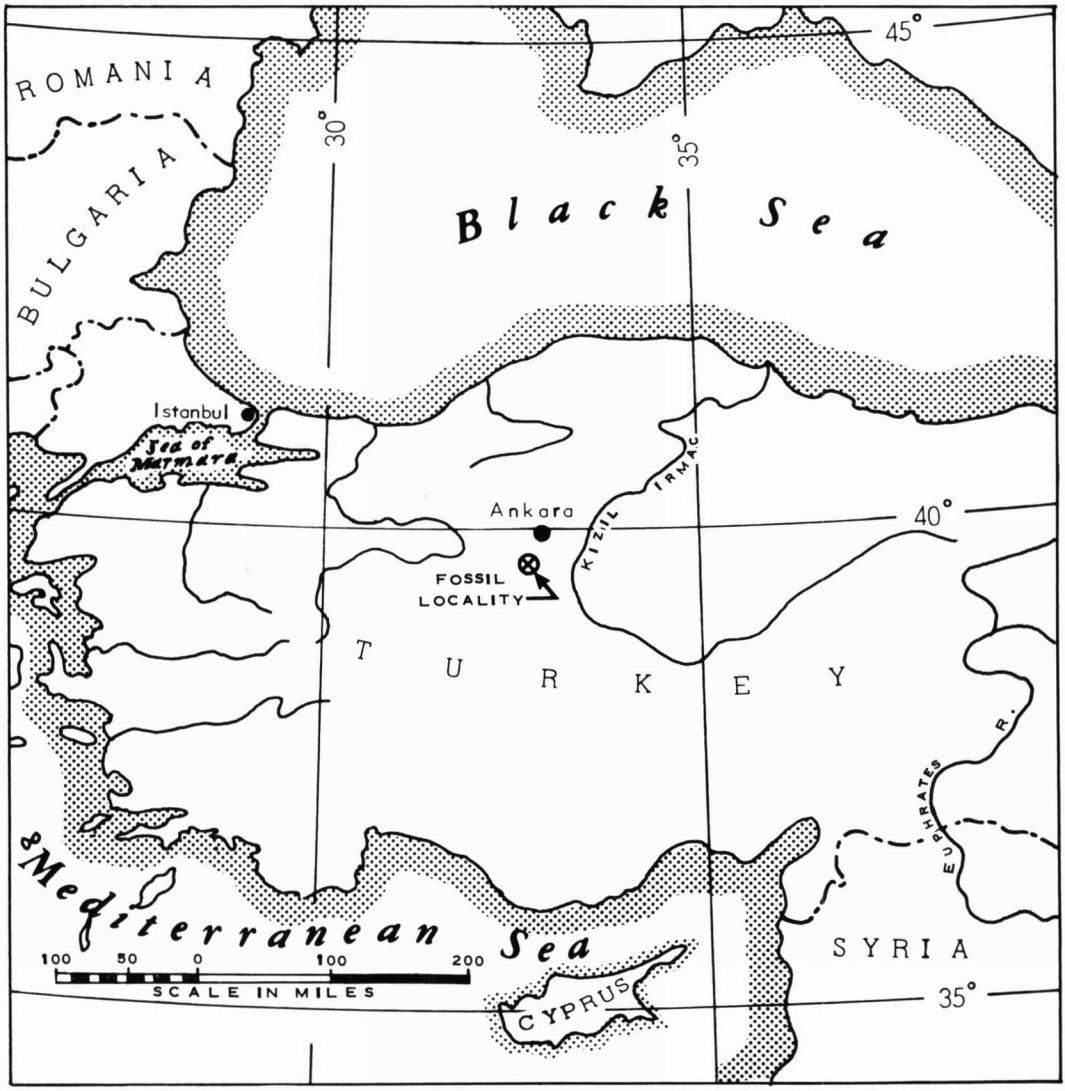


FIG. 1. Index map showing fossil locality.

Collections Tur-17 through Tur-32 were obtained from DALLY's Section 2, located one kilometer southwest of Section 1.

Tur-18. Permian limestone, base of section. Coll. DALLY 2-1779 A.

Tur-18. Permian limestone, 1.5 feet above base of section. Coll. DALLY 2-1780 A.

Tur-19. Permian limestone, 3.5 feet above base of section. Coll. DALLY 2-1781 A.

Tur-20. Permian limestone, 4.5 feet above base of section. Coll. DALLY 2-1782 A.

Tur-21. Permian limestone, 5.25 feet above base of section. Col. DALLY 2-1783 A.

Tur-22. Permian limestone, 6.25 feet above base of section. Coll. DALLY 2-1784 A.

Tur-23. Permian limestone, 7.25 feet above base of section. Coll. DALLY 2-1785 A.

Tur-24. Permian limestone, 8.5 feet above base of section. Coll. DALLY 2-1786 A.

Tur-25. Permian limestone, 9.25 feet above base of section. Coll. DALLY 2-1787 A.

Tur-26. Permian limestone, 10.25 feet above base of section. Coll. DALLY 2-1788 A.

Tur-27. Permian limestone, 11.25 feet above base of section. Coll. DALLY 2-1789 A.

Tur-28. Permian limestone, 12.25 feet above base of section. Coll. DALLY 2-1790 A.

Tur-29. Permian limestone, 14.25 feet above base of section. Coll. DALLY 2-1792 A.

Tur-30. Permian limestone, 15.25 feet above base of section. Coll. DALLY 2-1793 A.

Tur-31. Permian limestone, 16.25 feet above base of section. Coll. DALLY 2-1794 A.

Tur-32. Permian limestone, 17.5 feet above base of section. Coll. DALLY 2-1795 A.

SYSTEMATIC PALEONTOLOGY

[Type species of genera and holotype specimens of species marked by asterisk (*). All figures are unretouched photographs.]

Family ENDOTHYRIDAE Brady, 1884

Subfamily ENDOTHYRINAE Brady, 1884

Genus KAHLERINA Kochansky-Devidé & Ramovš, 1955

KAHLERINA *PACHYTHECA Kochansky-Devidé & Ramovš

Kahlerina pachytheca KOCHANSKY-DEVIDÉ & RAMOVŠ, 1955, Slovenska Akad. Znanosti Umetnosti, Razred Prirodoslovne Vede, Classis 4 (Hist. Nat.), Razprave, p. 385, 386, pl. 2, fig. 7-11; pl. 3, fig. 1-6, 9-13; pl. 8, fig. 2-5.

Shell minute, thickly discoidal to subspherical, umbilicate, with broadly rounded periphery; axis of coiling is shorter diameter; mature specimens have 5 to 6 whorls and measure 1.25 to 1.36 mm. in axial length, and 1.52 to 1.80 mm. in sagittal diameter; form ratio varies from 0.75 to 0.88. Inner whorls of some specimens are coiled askew to outer ones.

Spirotheca composed of thin tectum and relatively thick inner layer which possesses poorly visible fine alveolar structure analogous to keriotheca of some fusulinids; in the 4th volution spirotheca varies in thickness from 43 to 82 μ, averaging about 62 μ. Septa unfluted but convex anteriorly, composed of same elements as spirotheca and formed by simple inbending of latter; they are thick throughout their length, becoming slightly thicker along their basal margins; large septal pores are present, especially along basal margins of septa, which number 6 to 9 in 1st whorl, 11 to 12 in 2nd, 11 to 13 in 3rd, 10 to 11 in 4th, and 11 to 12 in 5th.

Proloculus small, outside diameter varying from 89 to 125 μ. Tunnel low and wide, tunnel angle measuring about 51° in 4th whorl and 55° in 5th. Tunnel formed by coalescence of several large septal pores which follow base of each septum; commonly this coalescence leaves remnants of basal margin of septum intact, and such remnants have been interpreted by some authors as parachomata. No chomata present.

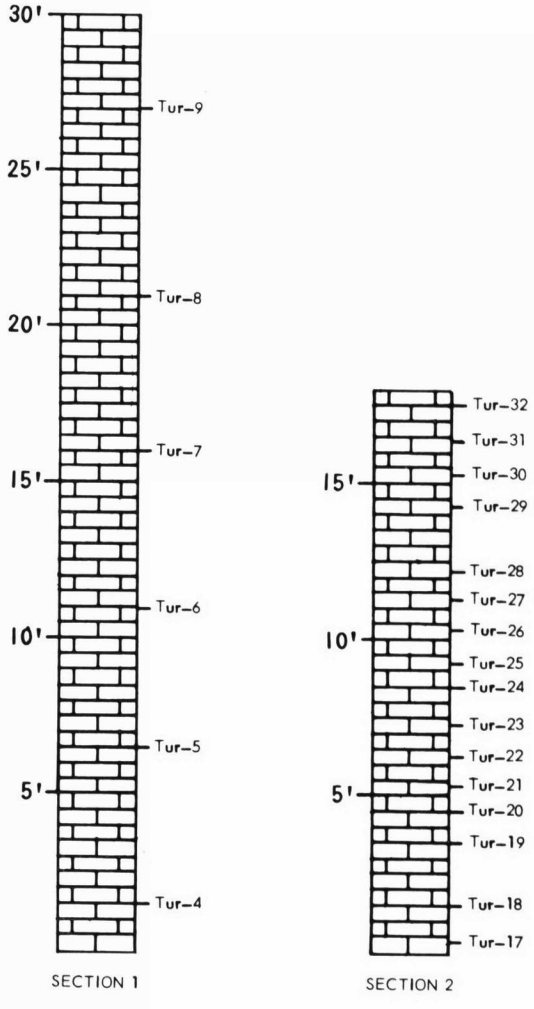


FIG. 2. Sections showing locations of fossil collections.

*Discussion.—Kahlerina *pachytheca,* the type species of the genus, more nearly resembles *K. africana* SKINNER & WILDE than any other described species. It differs from the latter in its more numerous volutions, larger form ratio, and commonly smaller proloculus. The above description is based on the Turkish specimens which agree so well with the type specimens that little doubt can exist as to their identity. The measurements of the former appear to lie near the upper limits of those given by KOCHANSKY-DEVIDÉ & RAMOVŠ.

Occurrence.—This species is common in colls. Tur-19, 20, 21, and 22, and rare in colls. Tur-23, 24, 25, 27, and 28.

Illustrations.—Plate 2, figures 1-6; 1-2, axial sec., ×20, ×40; 3-4, axial secs., ×40; 5-6, sagittal secs., ×40. 1-2 from coll. Tur-22; 3 from coll. Tur-24; 4 from coll. Tur-23; 5-6 from coll. Tur-19. (The specimens represented by the sagittal sections have been crushed.)

KAHLERINA GLOBOSA Skinner, n. sp.

Shell small, subspherical, slightly umbilicate; axis of coiling slightly shorter than sagittal diameter; mature individuals have 5 to 6 volutions, and measure 2.95 to 3.13 mm. in axial length, and 3.07 to 3.40 mm. in sagittal diameter; form ratio varies from 0.92 to 0.97.

Spirotheca composed of a thin tectum and thicker inner layer which displays a poorly visible alveolar structure corresponding to the keriotheca of some fusulinids; in the 4th whorl spirotheca measures 122 to 144 μ in thickness. Septa unfluted but slightly convex anteriorly, apparently formed by a simple inbending of the spirotheca and composed of the same elements as the latter; they are thick throughout their length, and number about 8 in 1st volution, 13 to 15 in 2nd, 12 to 13 in 3rd, about 12 in 4th, and 12 to 13 in 5th. Large septal pores present, particularly along basal margins of septa.

Proloculus small, its outside diameter varying from 157 to 220 μ. Tunnel low and wide, tunnel angle measuring 52° to 56° in 4th whorl, and 65° to 78° in 5th; tunnel formed by the coalescence of several large pores which follow base of each septum; commonly this coalescence leaves basal margin of septum intact, and such remnants have been interpreted as parachomata by some authors; they are especially obvious in the floor of the tunnel (Pl. 1, fig. 1-3). Weak chomata are present only on the proloculus and rarely in the first volution.

Discussion.—Kahlerina globosa SKINNER, n. sp., is the largest member of the genus presently known, being approximately twice as large as *K. pachytheca* KOCHANSKY-DEVIDÉ & RAMOVŠ for the same number of whorls. The large size and nearly globular shape distinguish it from all previously described species.

Occurrence.—This species is common in colls. Tur-21, 22, and 30, and rare in coll. Tur-28.

Illustrations.—Plate 1, figures 1-5; *1, axial sec. of holotype, ×20; 2-3, axial secs. of paratypes, ×20; 4-5, sagittal secs. of paratypes, ×20. 1 from coll. Tur-30; 2-3, 5 from coll. Tur-21; 4 from coll. Tur-28.

Family OZAWAINELLIDAE Thompson & Foster, 1937

Subfamily OZAWAINELLINAE Thompson & Foster, 1937

Genus REICHELINA Erk, 1941

REICHELINA sp.

Shell minute, lenticular, with sharply angular periphery; axis of coiling is the shorter diameter; my single axial section has 6½ volutions, measuring 0.50 mm. in axial length and 1.13 mm. in sagittal diameter; form ratio is 0.44.

Spirotheca thin, composed of thin tectum and somewhat thicker diaphanotheca; in 6th whorl spirotheca measures 22 μ in thickness. Septa thin and unfluted, composed of same elements as spirotheca. Since I have no sagittal sections, no septal count can be given.

Proloculus minute, its outside diameter measuring only 36 μ. Tunnel narrow, tunnel angle measuring 16° in 6th volution. Chomata moderately strong, asymmetrical, with steeper side adjacent to tunnel.

Discussion.—The material at hand is insufficient to permit meaningful comparison with other species.

Occurrence.—This is a very rare species, only two specimens having been found in coll. Tur-28.

Illustrations.—Plate 2, figures 7-9; 7-8, axial sec., ×20, ×40; 9, tang. sec., ×40. Both from coll. Tur-28.

Family FUSULINIDAE von Möller, 1878

Subfamily FUSULININAE von Möller

[*nom. transl.* Rhumbler, 1895; *emend.* Dunbar & Henbest, 1930]

Genus YANGCHIENIA Lee, 1933

YANGCHIENIA sp.

Shell small, fusiform, with nearly straight lateral slopes and bluntly pointed poles; first 2 to 2½ whorls are discoidal and coiled askew to later ones; mature specimens have about 10 volutions, and measure 2.09 to 2.41 mm. in length and 1.21 to 1.27 mm. in diameter; form ratio varies from 1.72 to 1.90.

Spirotheca composed of thin tectum and diaphanotheca, commonly with darker layer present inside diaphanotheca in equatorial region, but this is part of massive chomata deposits spreading across tops of chambers adjacent to the tunnel rather than a true inner tectorium; spirotheca in 9th volution measures 17 to 20 μ in thickness. Septa plane throughout and composed of same elements as spirotheca; in the only sagittal section in my material they number 22 in 3rd volution, 26 in 4th, 26 in 5th, 28 in 6th, 33 in 7th, 30 in 8th, 31 in 9th, and 32 in 10th; in one axial section (Pl. 3, fig. 6, 7) they number 9 in 1st whorl and 17 in 2nd. Septal pores are numerous.

Proloculus very small, its outside diameter varying from 62 to 76 μ. Tunnel narrow and about 0.7 as high as chambers; in 9th volution tunnel angle measures 20° to 22°. Chomata high and massive; nearly vertical on side adjacent to tunnel, and extending with only slightly diminished height nearly to poles, particularly in inner whorls.

Discussion.—This species resembles *Yangchienia thompsoni* Skinner & Wilde, but differs in its slightly smaller size and broader chomata. It also resembles *Y. tobleri* Thompson, but it is difficult to obtain a clear idea of the characters of the latter since the only specimen certainly assigned to it is represented by an incomplete tangential section.

Occurrence.—*Yangchienia* sp. is rare in colls. Tur-17, 19, 20, 28, 29, and 30.

Illustrations.—Plate 3, figures 6-9; 6-7, axial sec., ×20, ×40; 8, axial sec., ×40; 9, slightly oblique sagittal sec., ×40. 6-7 from coll. Tur-28; 8 from coll. Tur-19; 9 from coll. Tur-30.

Subfamily BOULTONIINAE Skinner & Wilde, 1954

Genus CODONOFUSIELLA Dunbar & Skinner, 1937

CODONOFUSIELLA sp.

Shell minute, consisting of coiled body followed by uncoiled flare; coiled portion thickly fusiform and composed of about 4.75 whorls, 1st of which is discoidal and coiled askew to later ones. This species is represented by one sagittal section and several oblique sections, so no measurement could be made of its length. Diameter of coiled portion is 0.64 mm., and height of flare is 0.85 mm.

Spirotheca thin, composed of tectum and diaphanotheca, its thickness in 4th whorl being about 22 μ. Septa intensely and regularly folded, and composed of same elements as spirotheca; they number about 14 in 2nd volution, 18 in 3rd, and 28 in 4th; 28 septa are counted in the uncoiled flare in this specimen.

Proloculus minute, its outside diameter measuring 72 μ. Oblique sections indicate that chomata are weak or absent.

Discussion.—This species does not appear to agree closely with any described form.

Occurrence.—*Codonofusiella* sp. has been found only in coll. Tur-30, where it is rare.

Illustrations.—Plate 3, figures 1-2; slightly oblique sagittal sec., ×20, ×40. From coll. Tur-30.

Genus RUSSIELLA Miklukho-Maklay, 1957

[emend. Sheng, 1963]

RUSSIELLA sp.

Shell minute, slender subcylindrical, with bluntly rounded poles; mature individuals have about 5 whorls, first 1.5 of which are discoidal and coiled at an angle of 90° to later ones; such specimens measure 2.58 to 2.91 mm. in length and 0.63 to 0.65 mm. in diameter; form ratio varies from 4.09 to 4.47.

Thin spirotheca composed of tectum and diaphanotheca; in 4th whorl its thickness measures about 16 μ. Septa composed of same elements as spirotheca and intensely and regularly fluted from pole to pole; fluting peculiar in that septal loops are commonly wider at top than at base. Rather heavy secondary deposits coat septa to produce strong axial filling. No septal count is available.

Proloculus minute, its outside diameter varying from 46 to 59 μ. Tunnel obscure, but very narrow. No chomata observed.

Discussion.—This species is very similar to *Russiella pulchra* MIKLUKHO-MAKLAY and may be identical with the latter. It appears to be somewhat larger for a given number of volutions, and to have a slightly larger proloculus.

Occurrence.—*Russiella* sp. is very rare in colls. Tur-27 and Tur-30.

Illustrations.—Plate 3, figures 3-5; 3-4, axial sec., ×20, ×40; 5, axial sec., ×40. From collection Tur-30.

Genus PARADUNBARULA Skinner, n. gen.

Type species.—*Paradunbarula *dallyi* SKINNER, n. sp.

Shell small, inflated fusiform to subglobular, with convex lateral slopes and bluntly rounded poles. Mature individuals possess 4 to 6.5 volutions, the first 1.5 to 2 of which are discoidal in shape and coiled askew to later ones. Coiling is loose, except in juvenarium. Proloculus minute. Spirotheca thin, composed of tectum, diaphanotheca, and inner tectorium of secondary material (Pl. 7, figs. 1, 3). Septa intensely fluted from pole to pole, composed of same elements as spirotheca, with tectorium extending down both anterior and posterior faces. Septal folds high, extending to tops of chambers. Septal pores numerous. Tunnel singular, about 0.3 as high as chambers and moderately wide. Weak chomata present in early whorls, but absent in later ones.

Discussion.—*Paradunbarula* generally resembles *Palaeofusulina* DEPRAT, but differs in possessing a minute proloculus and an askew juvenarium. It also resembles *Dunbarula* CIRY, from which it differs in its more inflated shape, greater intensity of septal fluting, and nature of its juvenarium. In the latter genus the juvenarium consists of 2.5 to 4 lenticular whorls with a bluntly angular periphery (compare Pl. 7, figs. 1-3 with Pl. 11, figs. 1-3). In addition, *Dunbarula* possesses well-developed chomata and lacks an inner tectorium.

In addition to the type species, *Palaeofusulina pamirica* LEVEN apparently belongs in this genus, and *P. laxa* SHENG is provisionally assigned to *Paradunbarula*.

Age.—Middle to Upper Permian.

PARADUNBARULA *DALLYI Skinner, n. sp.

Shell small, inflated fusiform to subglobular, with convex lateral slopes and bluntly rounded poles; mature specimens have 5.5 to 6 volutions, the first 1.5 to 2 of which are discoidal and coiled askew to later ones; such individuals measure 2.21 to 2.76 mm. in length and 1.59 to 1.88 mm. in diameter; form ratio varies from 1.32 to 1.52; coiling is loose, except in juvenarium.

Spirotheca thin, composed of tectum, diaphanotheca, and inner tectorium; in 4th whorl spirotheca measures 23 to 40 μ in thickness; averaging about 32 μ. Septa intensely fluted from pole to pole; composed of same elements as spirotheca, with tectorium extending down both anterior and posterior faces; septal folds high, reaching to tops of chambers; septal pores numerous. Septa number about 8 in 1st volution, 11 in 2nd, 12 to 17 in 3rd, 21 to 24 in 4th, 29 to 32 in 5th, and about 37 in 6th.

Proloculus minute, its outside diameter varying from 43 to 61 μ. Tunnel moderately wide; in 5th whorl tunnel angle measures 30° to 43°, averaging about 37°. Weak chomata are present in early volutions, but absent in later ones.

Discussion.—*Paradunbarula *dallyi* SKINNER, n. sp., closely resembles *P. pamirica* (LEVEN), but differs from the latter in its much smaller size, being only about 0.7 as large for the same number of volutions. No other described species might be confused with it. This species is named for Dr. JESSE L. DALLY.

Occurrence.—This species is abundant in collections Tur-4, 6, 8, and 9, where it is associated with *Boultonia erki* SKINNER, n. sp.

Illustrations.—Plate 4, figures 1-3; *1-*2, axial sec. of holotype, ×20, ×40; 3, axial sec. of paratype, ×40. 1-2 from coll. Tur-8; 3 from coll. Tur-9.——Plate 5, figures 1-4; 1-2, axial secs. of paratypes, ×40; 3-4, sagittal secs. of paratypes, ×40. 1 from coll. Tur-9; 2-4 from coll. Tur-6.——Plate 6, figures 1-4; 1, sagittal sec. of paratype, ×40; 2, part of same specimen, ×100; 3, part of specimen shown in Pl. 4, fig. 3, ×100; 4, part of specimen shown in Pl. 5, fig. 1, ×100. 1, 2 from coll. Tur-8; 3, 4, from coll. Tur-9.——Plate 7, figures 1-3; 1, part of specimen shown in Pl. 5, fig. 3, showing wall structure, ×100; 2, part of axial sec. of paratype, ×100; 3, part of sagittal sec. of paratype, ×100. All from collection Tur-6.

Genus BOULTONIA Lee, 1927

BOULTONIA ERKI Skinner, n. sp.

Shell minute, thickly fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles; mature specimens have 4.5 to 6 volutions, the first 1.5 to 2 of which are discoidal in shape and coiled askew to later ones; coiling is regular

and moderately tight; such individuals measure 1.03 to 1.28 mm. in length and 0.59 to 0.85 mm. in diameter; form ratio varies from 1.50 to 1.88.

Spirotheca thin, composed of tectum and diaphanotheca; in 4th whorl its thickness measures 30 to 42 μ. Septa strongly fluted from pole to pole and composed of same elements as spirotheca; septal folds high, reaching more than half way to tops of chambers; septal pores numerous, appearing as dark spots because of plugging with secondary material. Septa number about 9 in 1st whorl, 10 in 2nd, 9 to 11 in 3rd, 14 to 16 in 4th, 19 to 23 in 5th, and 30 to 31 in 6th.

Proloculus minute, its outside diameter varying from 37 to 66 μ, averaging about 49 μ. Tunnel moderately wide, tunnel angle measuring 33° to 44° in 5th volution. Chomata well developed, about 0.3 as high as chambers.

Discussion.—Boultonia erki SKINNER, n. sp., does not closely resemble any other described form. In general, it looks very much like the coiled portion of some species of *Codonofusiella,* such as *C. extensa* SKINNER & WILDE. The new species exhibits no tendency to uncoil in the outermost whorl, however. It is named in honor of Dr. A. SUAT ERK.

Occurrence.—This species is abundant in colls. Tur-4, 6, 8, and 9, where it is associated with *Paradunbarula *dallyi* SKINNER, n. sp.

Illustrations.—Plate 8, figures 1-10; *1-*2, axial section of holotype, ×20, ×40; 3-6, axial secs. of paratypes, ×40; 7-9, sagittal secs. of paratypes, ×40; *10, axial sec. of holotype, ×100. 1-2, 4-5, 9-10 from coll. Tur-6; 3, 8 from coll. Tur-8; 6-7 from coll. Tur-9.——Plate 9, figure 1, specimen shown in Pl. 8, fig. 7, to illustrate wall structure, ×100. From coll. Tur-9.

Genus DUNBARULA Ciry, 1948

DUNBARULA TUMIDA Skinner, n. sp.

Shell minute, inflated fusiform to ellipsoidal, with convex lateral slopes and bluntly rounded to bluntly pointed poles; mature individuals have 5 to 6 volutions, first 2.5 to 4 of which are lenticular in shape and coiled askew to later ones; whorls outside juvenarium are rather loosely coiled; such specimens measure 1.36 to 1.91 mm. in length and 0.89 to 1.20 mm. in diameter; form ratio varies from 1.44 to 1.70.

Spirotheca thin, composed of tectum and diaphanotheca; in vicinity of tunnel thin secondary deposits may be present on both inner and outer surfaces of spirotheca, but these are related to chomata rather than being true tectoria, and they are absent in lateral portions of shell; in some specimens fine mural pores can be seen traversing spirotheca; in 4th volution spirotheca measures 25 to 33 μ in thickness. Septa moderately but irregularly fluted throughout shell and composed of the same elements as spirotheca; in equatorial region both anterior and posterior faces of septa are coated with secondary material; septal pores abundant, appearing as dark spots because of plugging with secondary material (Pl. 9, fig. 7); septa number 8 to 12 in 1st volution, 13 to 16 in 2nd, 15 to 17 in 3rd, 15 to 17 in 4th, and 19 to 24 in 5th.

Proloculus minute, its outside diameter varying from 48 to 78 μ. Tunnel low and moderately wide; tunnel angle in 5th whorl measures 32° to 43°, averaging about 36°. Chomata low but conspicuous because of thinness of spirotheca.

Discussion.—Dunbarula tumida SKINNER, n. sp., is somewhat similar to *D. nana* KOCHANSKY-DEVIDÉ & RAMOVŠ, but differs from that species in its markedly larger size for the same number of whorls and in its somewhat stronger septal fluting.

Occurrence.—This species is common in colls. Tur-5, 7, 19, 21, 22, 29, and 32, and abundant in colls. Tur-30 and Tur-31.

Illustrations.—Plate 9, figures 2-7; *2-*3, axial sec. of holotype, ×20, ×40; 3-7, axial secs. of paratypes, ×40. 2-4 from coll. Tur-31; 5 from coll. Tur-32; 6-7 from coll. Tur-30.——Plate 10, figures 1-7; 1-2, axial secs. of paratypes, ×40; 3-6, sagittal secs. of paratypes, ×40; 7, part of specimen shown in Pl. 9, fig. 4, ×100. 1-2, 5, 7 from coll. Tur-31; 3 from coll. Tur-5; 4 from coll. Tur-30; 6 from coll. Tur-32.——Plate 11, figures 1-3; 1, part of specimen shown in Pl. 9, fig. 6, ×100; 2, part of specimen shown in Pl. 10, fig. 3, ×100; 3, specimen shown in Pl. 10, fig. 6, illustrating wall structure, ×100. 1 from coll. Tur-30, 2 from coll. Tur-5; 3 from coll. Tur-32.

DUNBARULA PUSILLA Skinner, n. sp.

Shell minute, fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles; mature specimens have 5 to 6 volutions, first 2 to 4 of which are lenticular and coiled askew to later ones; such individuals measure 1.03 to 1.46 mm. in length and 0.54 to 0.61 mm. in diameter; form ratio varies from 1.89 to 2.38.

Spirotheca thin, composed of tectum and diaphanotheca; in 4th whorl its thickness measures 14 to 25 μ, averaging about 20 μ. Septa moderately fluted from pole to pole and composed of same elements as spirotheca; septal pores numerous;

septa number 7 to 8 in 1st whorl, 12 to 15 in 2nd, 15 to 20 in 3rd, 16 to 22 in 4th, and 18 to 20 in 5th.

Proloculus minute, its outside diameter commonly measuring 33 to 49 μ; one specimen (Pl. 12, fig. 1) has an unusually large proloculus which measures 86 μ. Tunnel low and moderately wide; tunnel angle varies from 35° to 43° in 5th volution. Chomata low and narrow.

Discussion.—Dunbarula pusilla Skinner, n. sp., is about the same in size as *D. nana* Kochansky-Devidé & Ramovš, but may be readily distinguished from that species by its more slender shape, larger form ratio, and somewhat narrower tunnel.

Occurrence.—This species is rare in colls. Tur-20, 28, 29, 30, and 31, and common in colls. Tur-5, 7, 19, 21, and 22.

EXPLANATION OF PLATES

[Type species of genera marked by asterisk(*)]

Plate 1, figures 1-5, *Kahlerina globosa* Skinner, n. sp. (p. 4).

Plate 2, figures 1-6, *Kahlerina pachytheca* Kochansky-Devidé & Ramovš (p. 3); 7-9, *Reichelina* sp. (p. 4).

Plate 3, figures 1-2, *Codonofusiella* sp. (p. 5); 3-5, *Russiella* sp. (p. 5); 6-9, *Yangchienia* sp. (p. 5).

Plate 4, figures 1-3, *Paradunbarula *dallyi* Skinner, n. gen., n. sp. (p. 6).

Plate 5, figures 1-4, *Paradunbarula *dallyi* Skinner, n. gen., n. sp. (p. 6).

Plate 6, figures 1-4, *Paradunbarula *dallyi* Skinner, n. gen., n. sp. (p. 6).

Plate 7, figures 1-3, *Paradunbarula *dallyi* Skinner, n. gen., n. sp. (p. 6).

Plate 8, figures 1-10, *Boultonia erki* Skinner, n. sp. (p. 6).

Plate 9, figures 1, *Boultonia erki* Skinner, n. sp. (p. 6); 2-7, *Dunbarula tumida* Skinner, n. sp. (p. 7).

Plate 10, figures 1-7, *Dunbarula tumida* Skinner, n. sp. (p. 7).

Plate 11, figures 1-3, *Dunbarula tumida* Skinner, n. sp. (p. 7); 4-9, *Dunbarula pusilla* Skinner, n. sp. (p. 7).

Plate 12, figures 1-4, *Dunbarula pusilla* Skinner, n. sp. (p. 7); 5-12, *Schwagerina solita* Skinner, n. sp. (p. 9).

Plate 13, figures 1-7, *Schwagerina ciryi* Skinner, n. sp. (p. 9); 8, *Schwagerina navillei* Erk (p. 9).

Plate 14, figures 1-5, *Schwagerina navillei* Erk (p. 9).

Plate 15, figures 1-7, *Schwagerina splendens* Skinner, n. sp. (p. 10).

Plate 16, figures 1-3, *Schwagerina splendens* Skinner, n. sp. (p. 10).

Plate 17, figures 1-6, *Chusenella extensa* Skinner, n. sp. (p. 10).

Plate 18, figures 1-2, *Chusenella extensa* Skinner, n. sp. (p. 10); 3, *Chusenella solida* Skinner, n. sp. (p. 11).

Plate 19, figures 1-4, *Chusenella solida* Skinner, n. sp. (p. 11), 5-9, *Chusenella minuta* Skinner, n. sp. (p. 11).

Plate 20, figures 1-4, *Neoschwagerina ventricosa* Skinner, n. sp. (p. 11).

Plate 21, figures 1-4, *Neoschwagerina ventricosa* Skinner, n. sp. (p. 11).

Plate 22, figures 1-5, *Neoschwagerina ventricosa* Skinner, n. sp. (p. 11).

Plate 23, figures 1-3, *Neoschwagerina ventricosa* Skinner, n. sp. (p. 11).

Plate 24, figures 1-6, *Neoschwagerina pinguis* Skinner, n. sp. (p. 12).

Plate 25, figures 1-4, *Neoschwagerina pinguis* Skinner, n. sp. (p. 12).

Plate 26, figures 1-2, *Neoschwagerina pinguis* Skinner, n. sp. (p. 12).

Plate 27, figures 1-2, *Neoschwagerina pinguis* Skinner, n. sp. (p. 12).

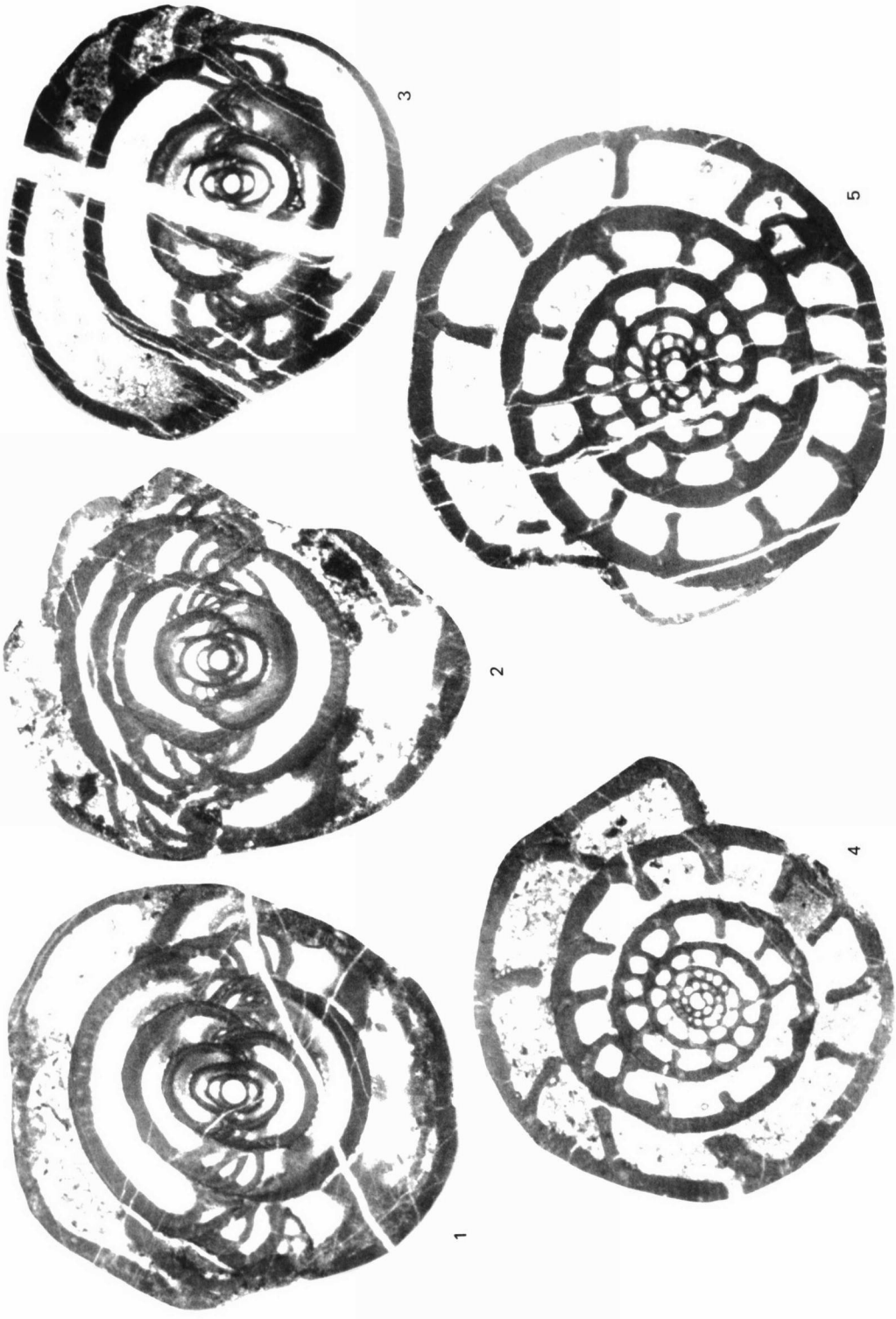
Plate 28, figures 1-2, *Neoschwagerina pinguis* Skinner, n. sp. (p. 12).

Plate 29, figures 1-4, *Yabeina opima* Skinner, n. sp. (p. 13).

Plate 30, figures 1-4, *Yabeina opima* Skinner, n. sp. (p. 13).

Plate 31, figures 1-2, *Yabeina opima* Skinner, n. sp. (p. 13).

Plate 32, figures 1-2, *Yabeina opima* Skinner, n. sp. (p. 13).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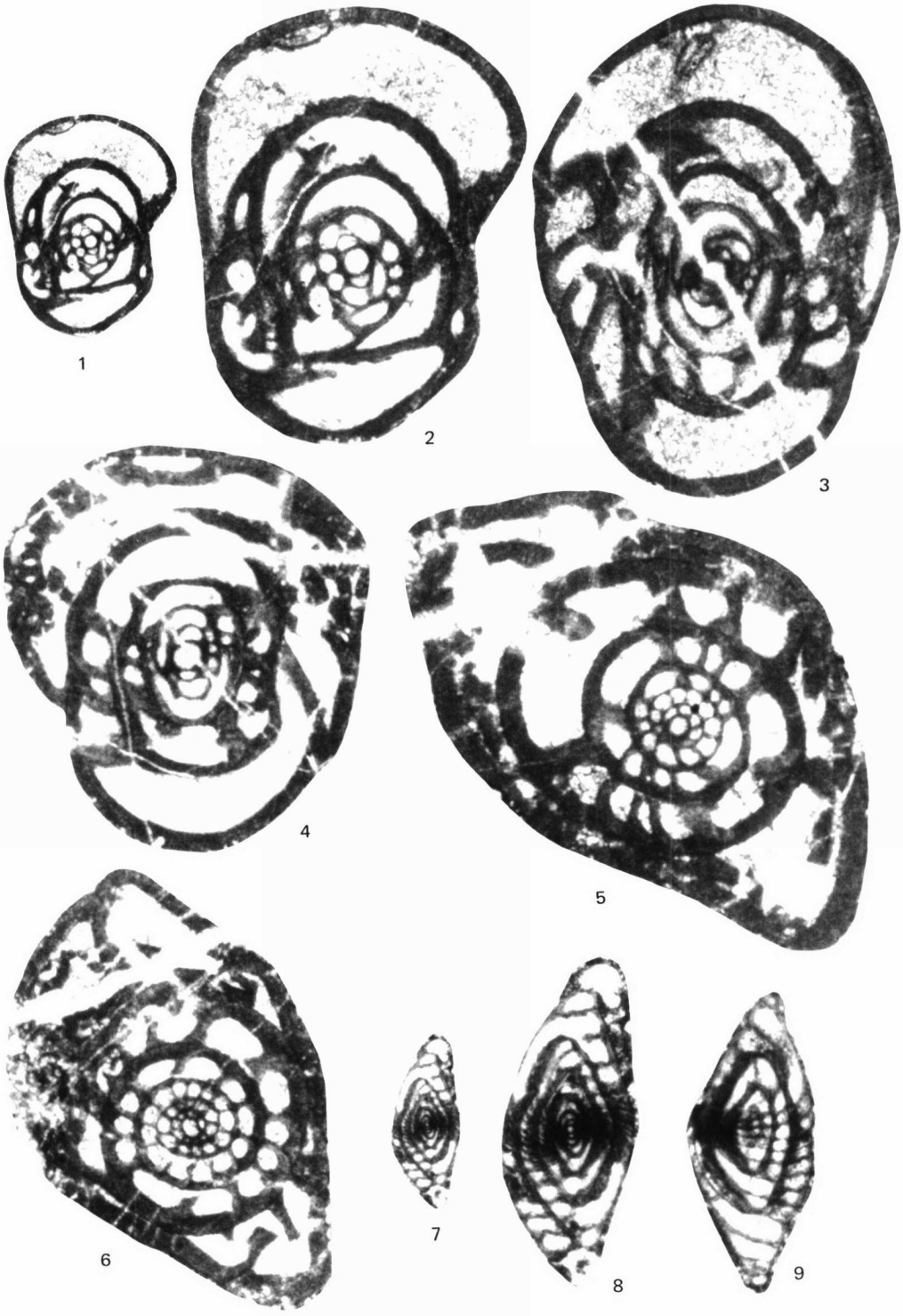
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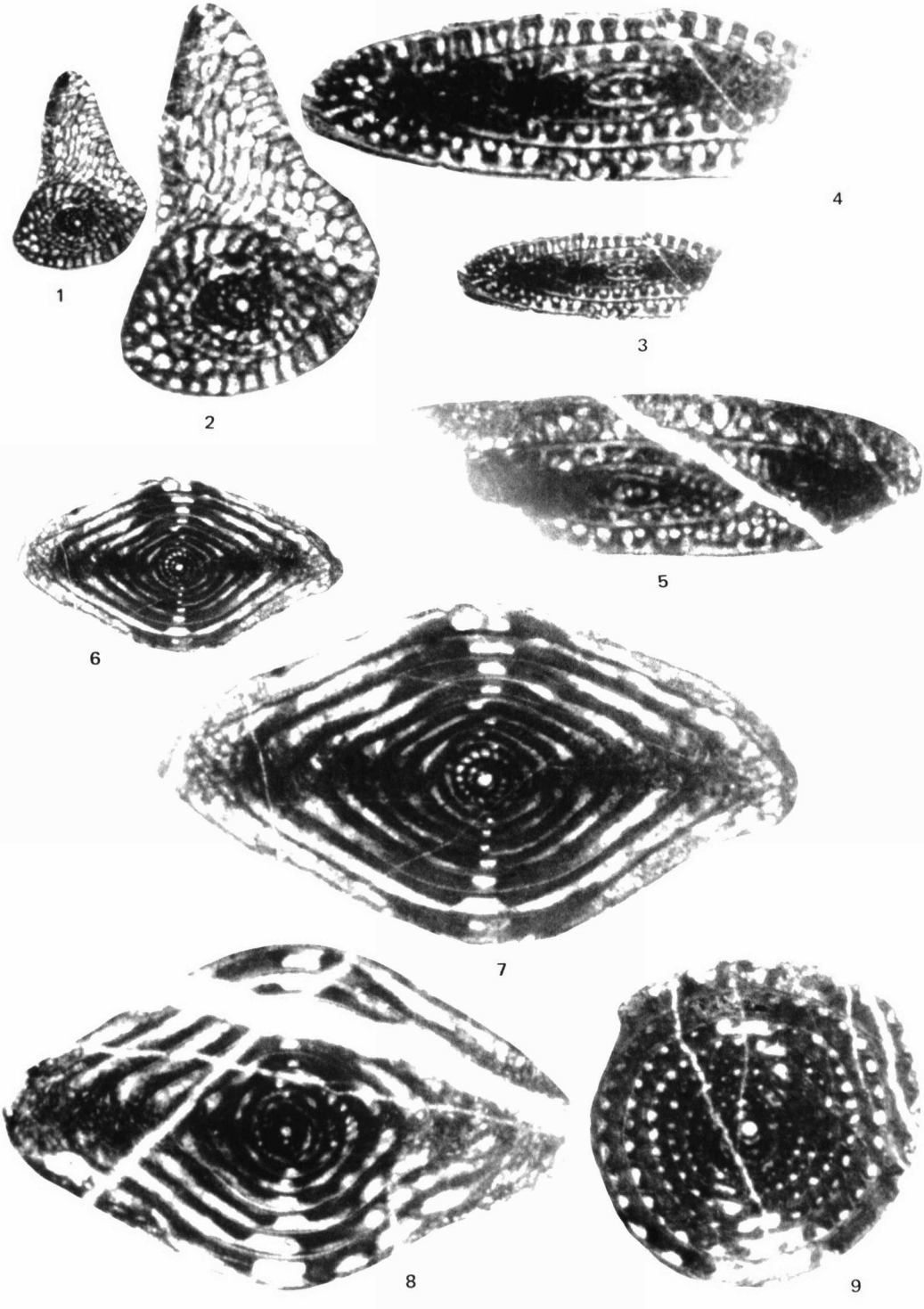
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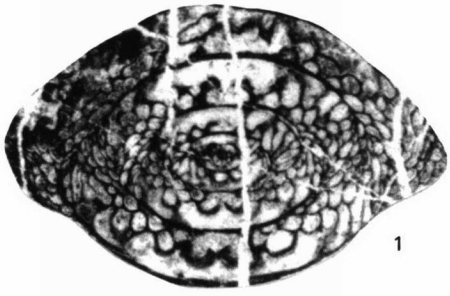

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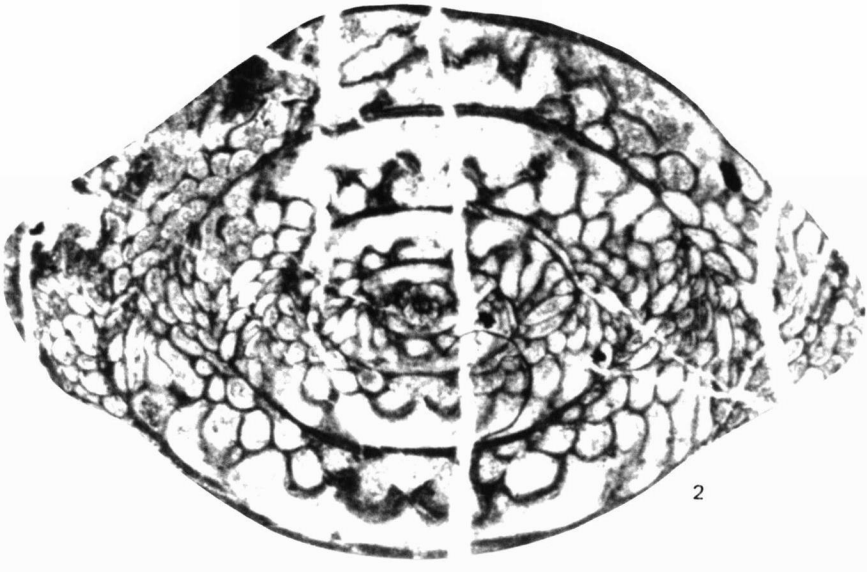

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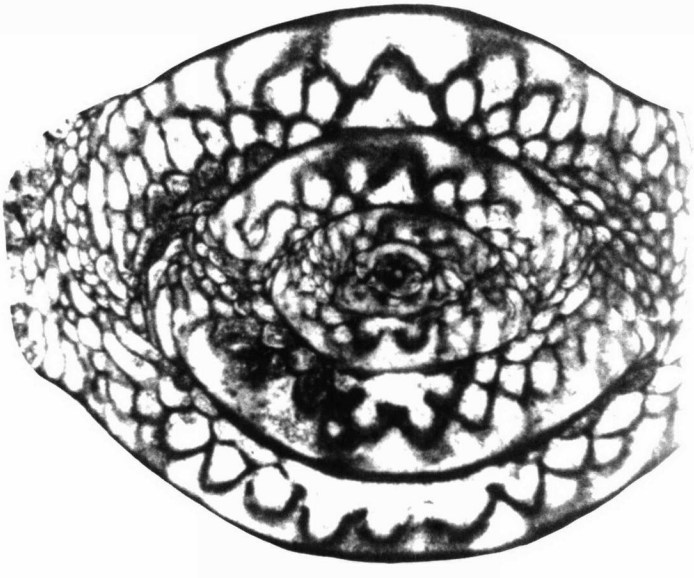

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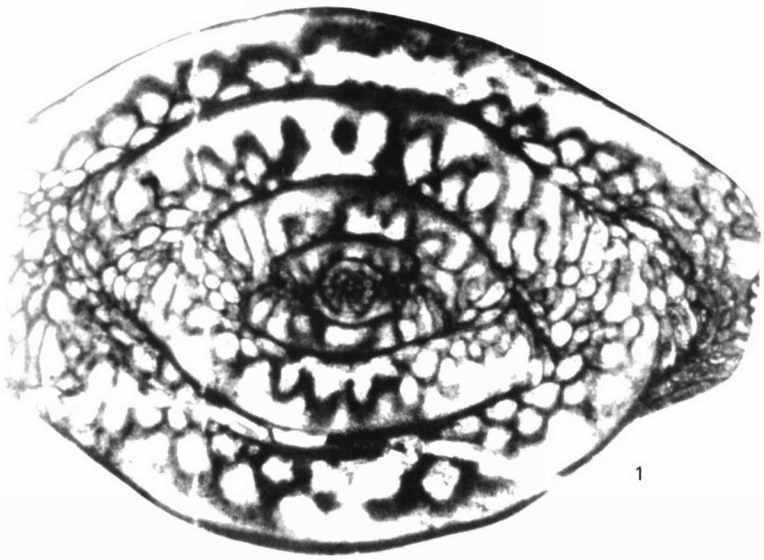

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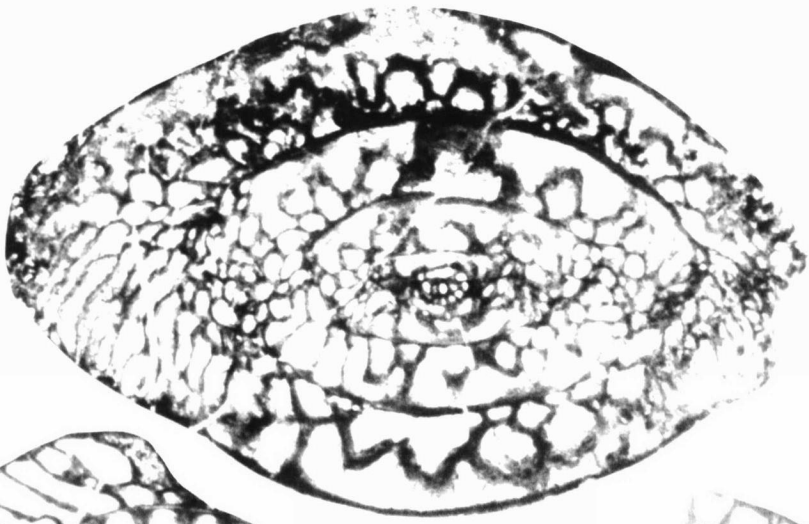

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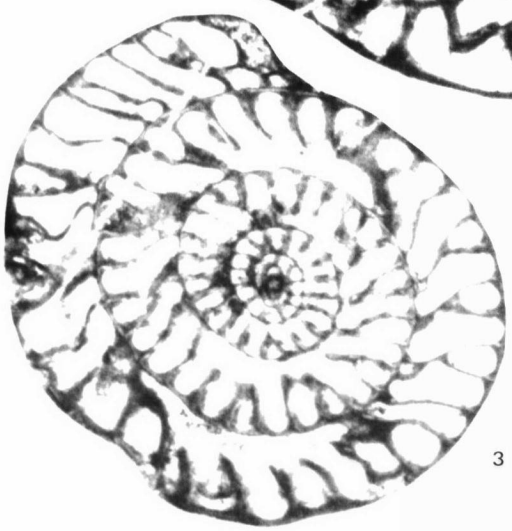

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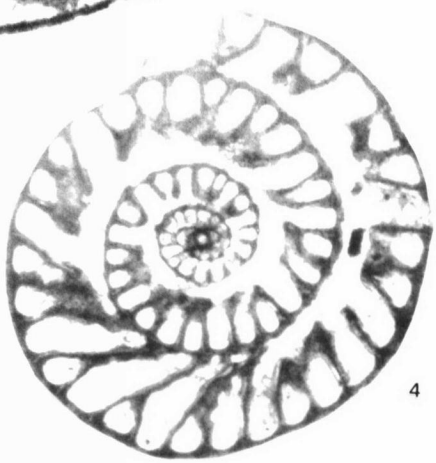

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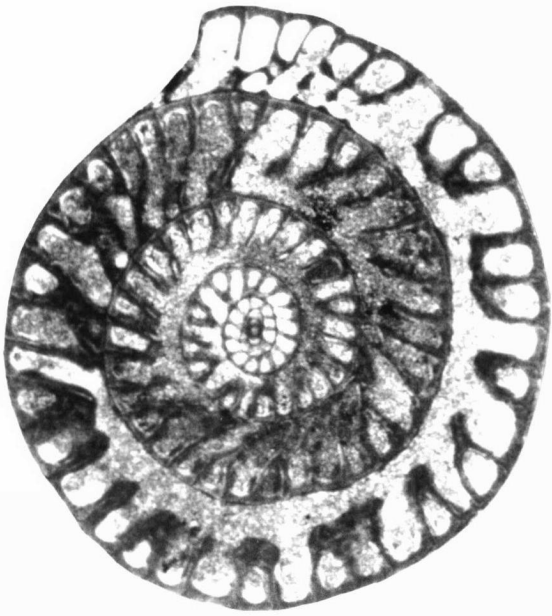

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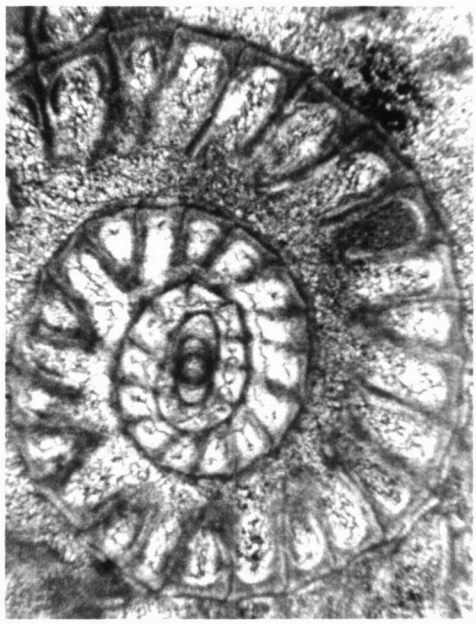

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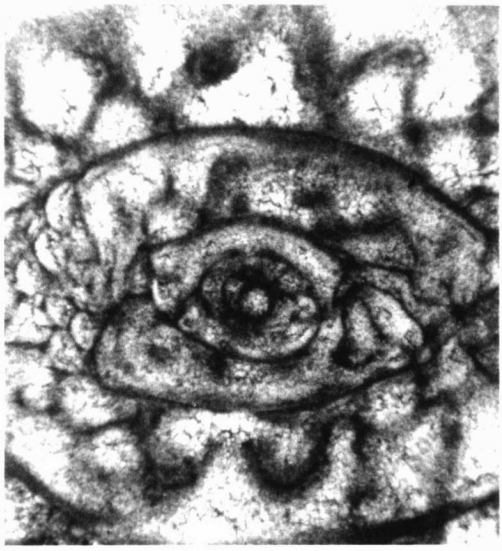

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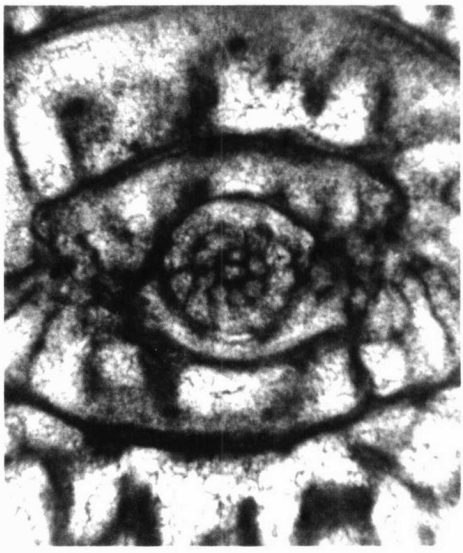

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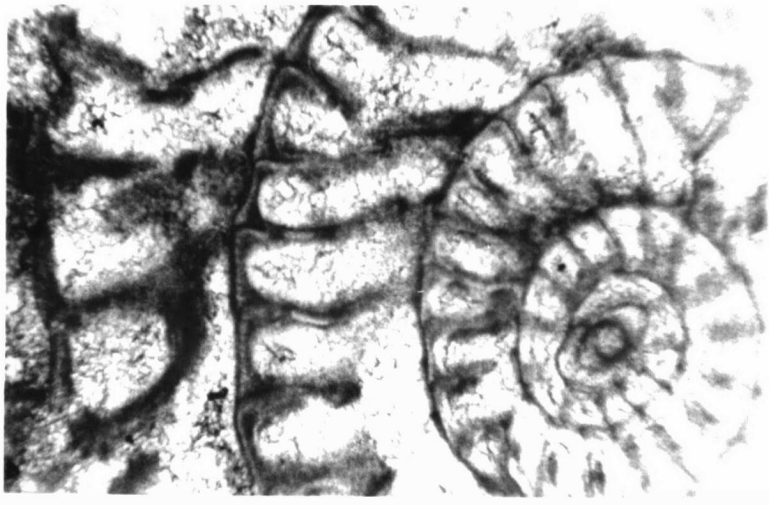

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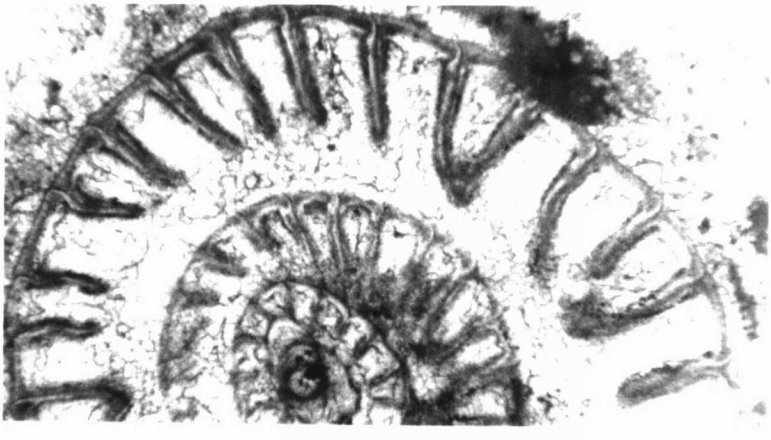

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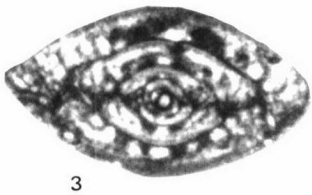

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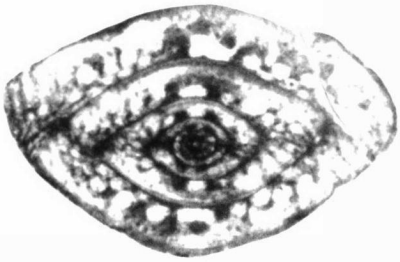

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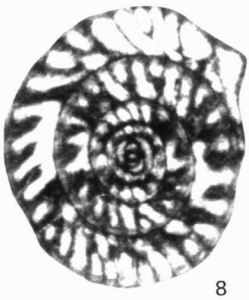

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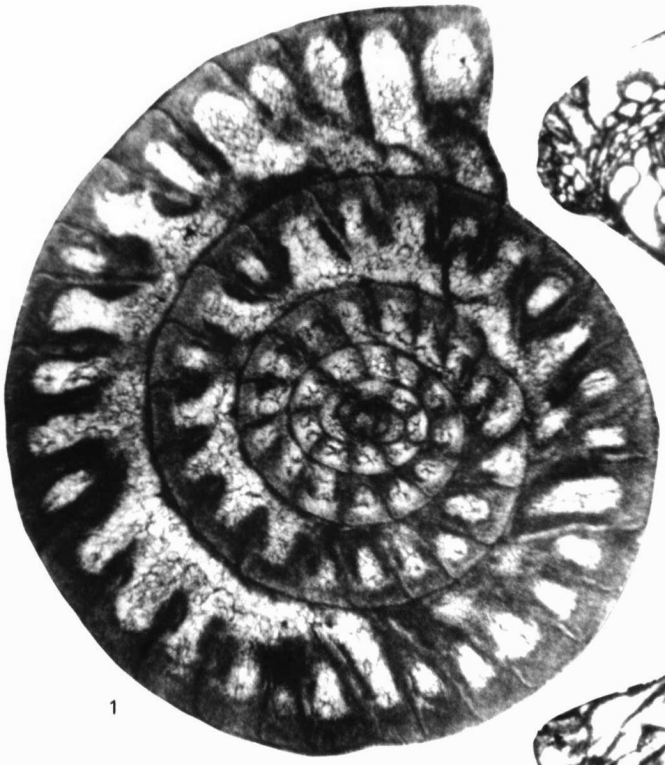

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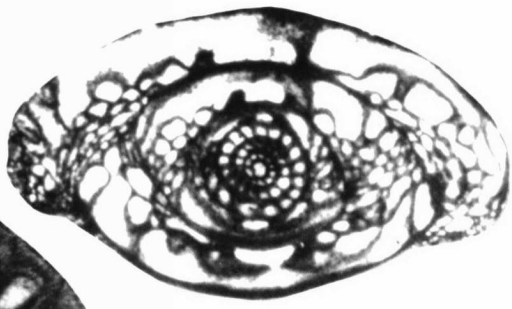

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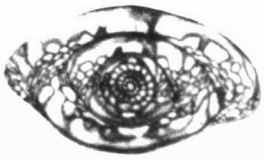

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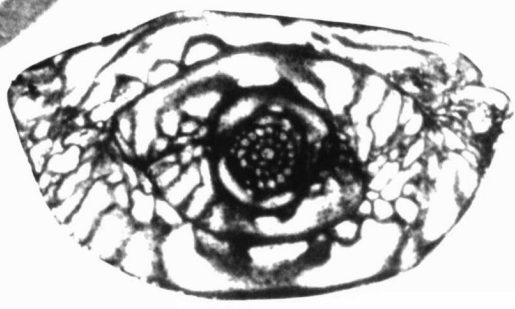

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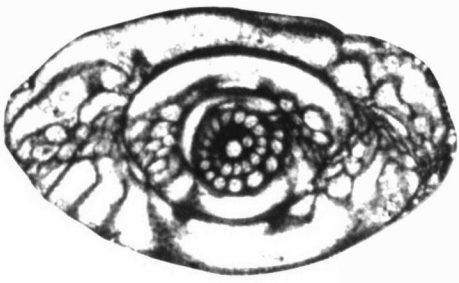

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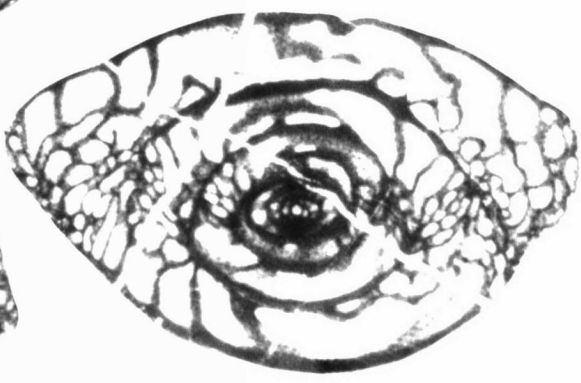

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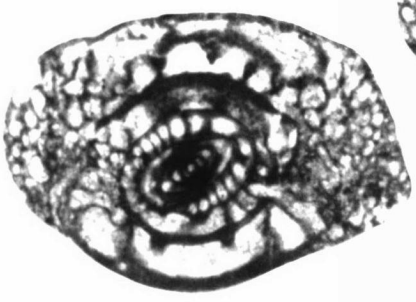

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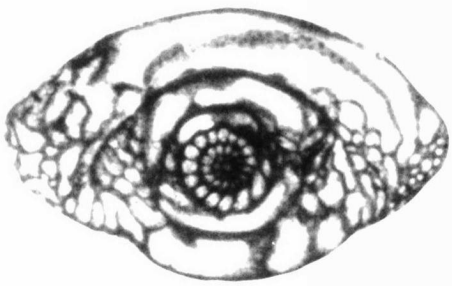

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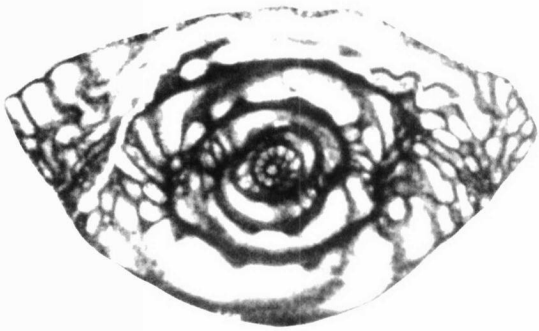

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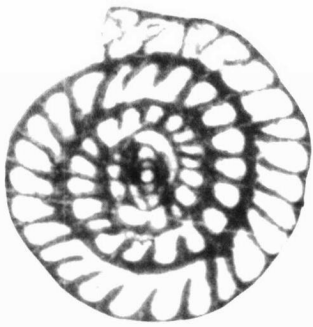

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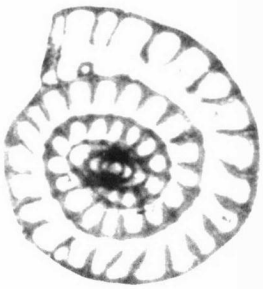

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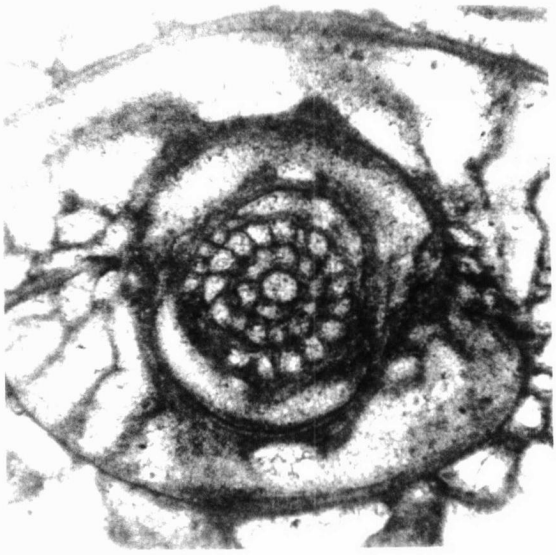

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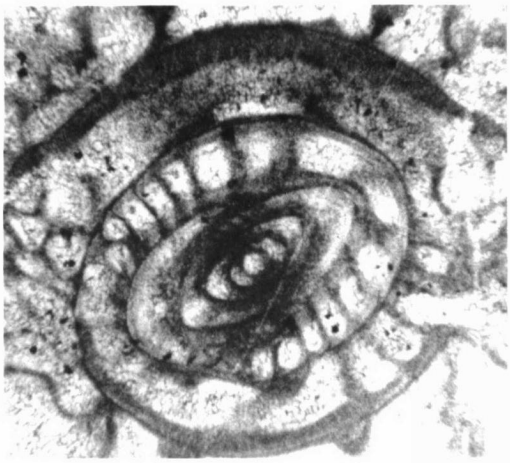

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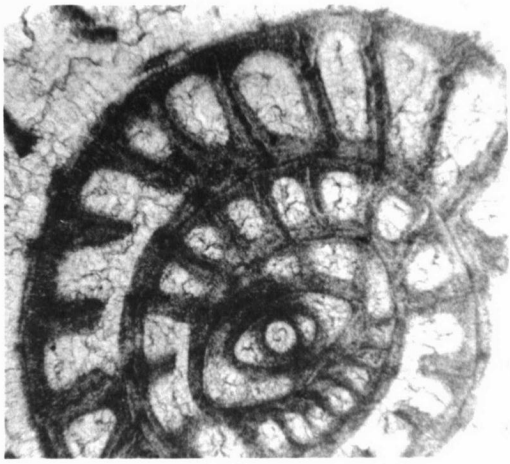

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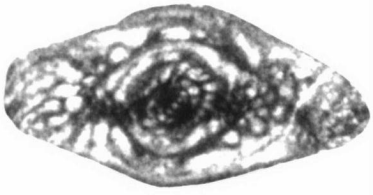

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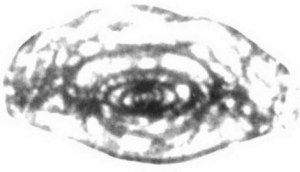

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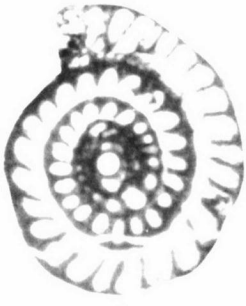

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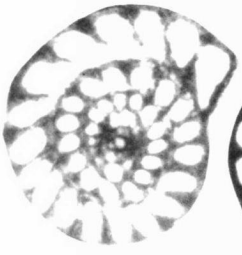

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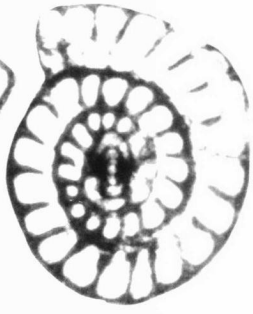

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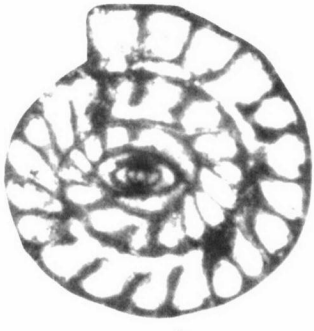

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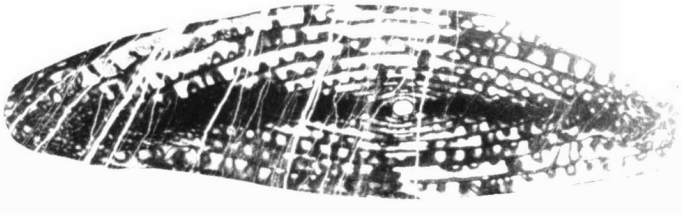

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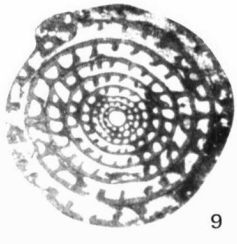

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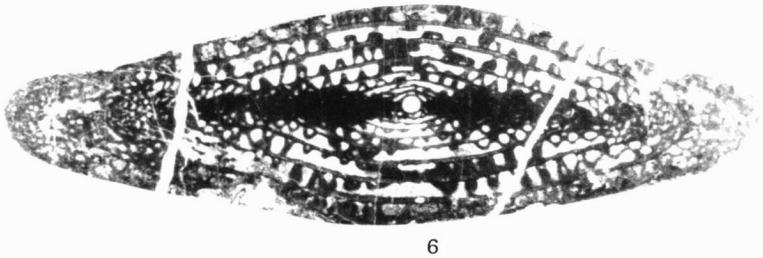

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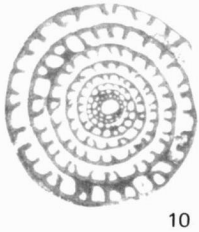

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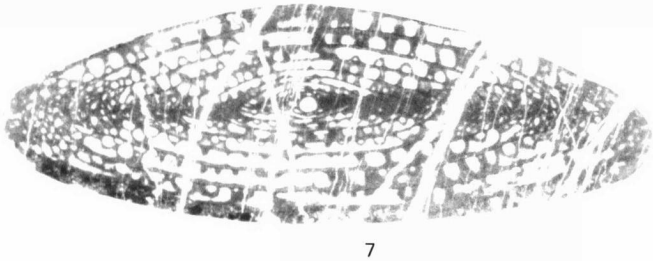

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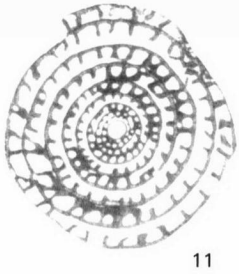

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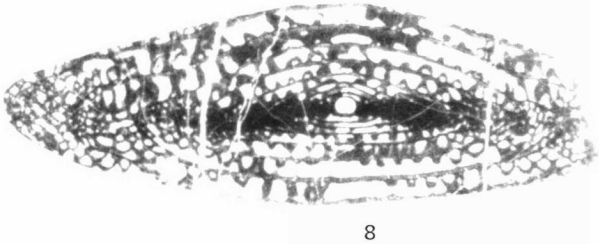

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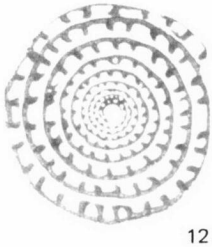

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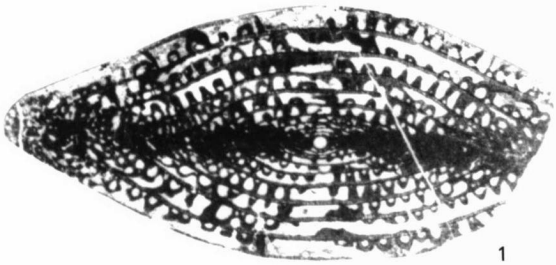

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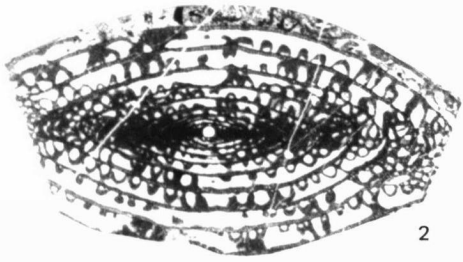

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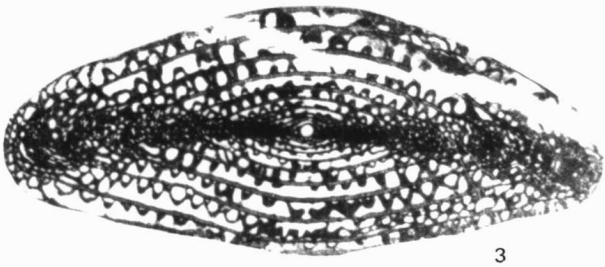

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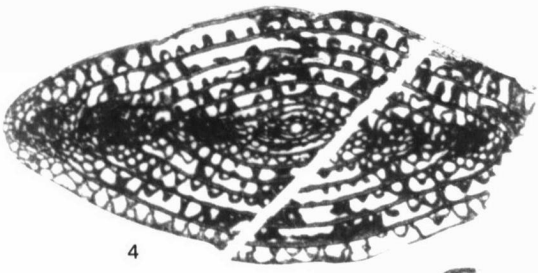

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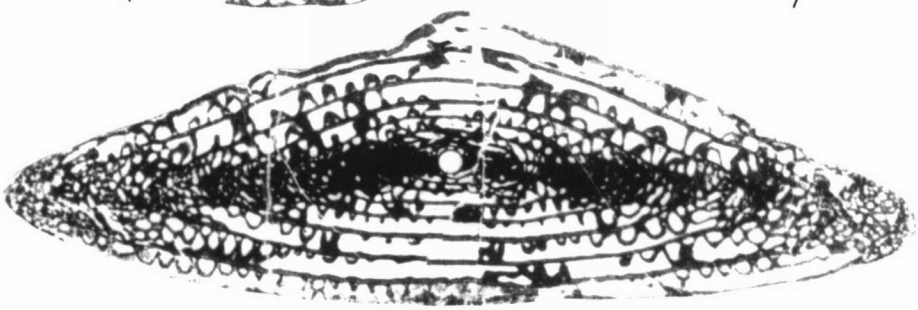

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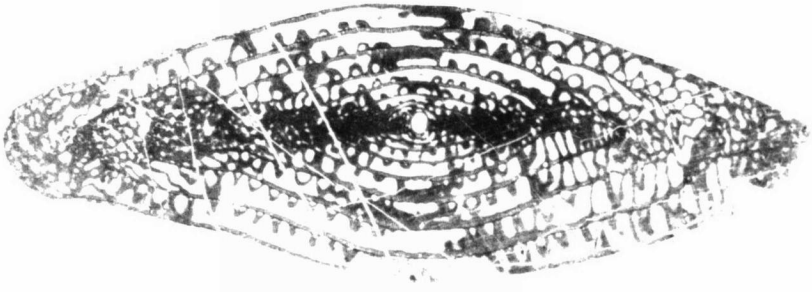

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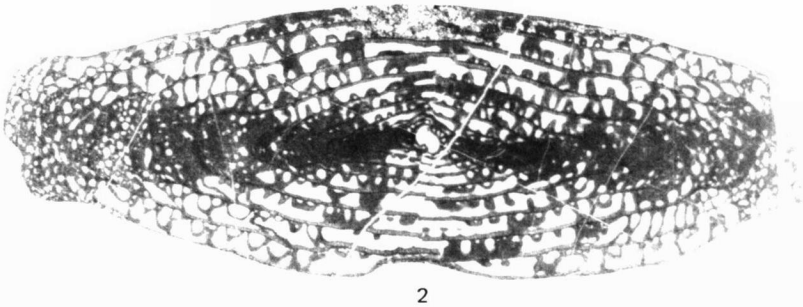

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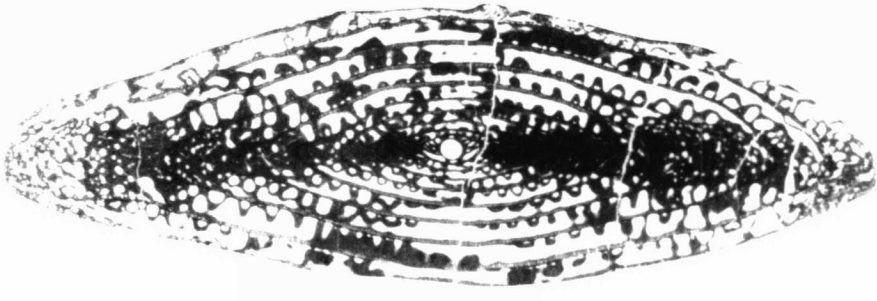

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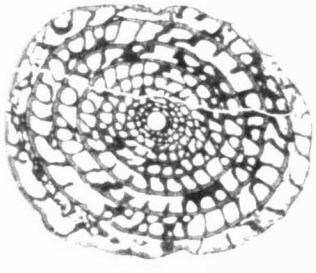

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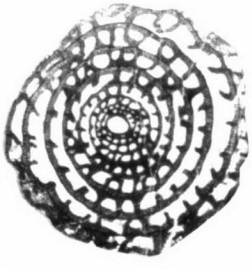

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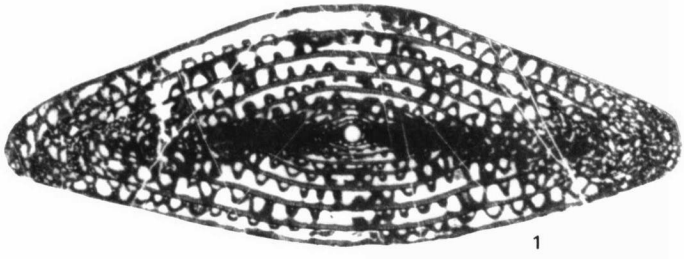

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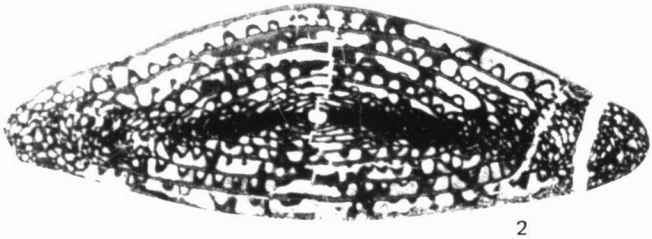

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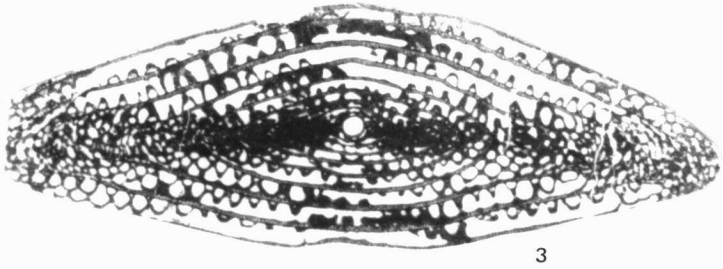

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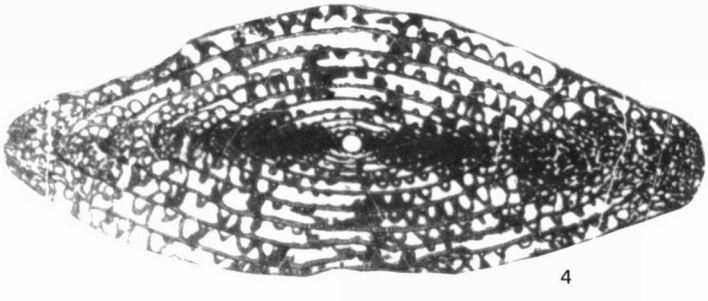

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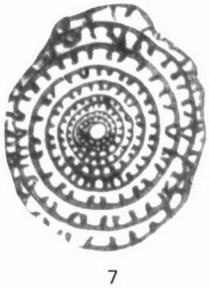

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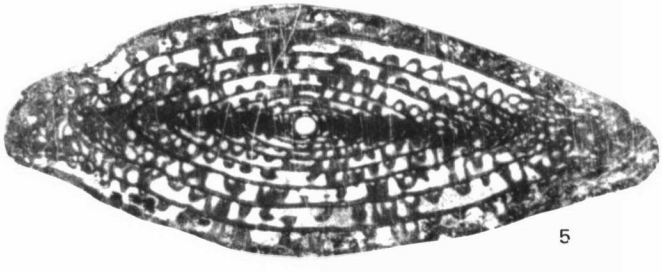

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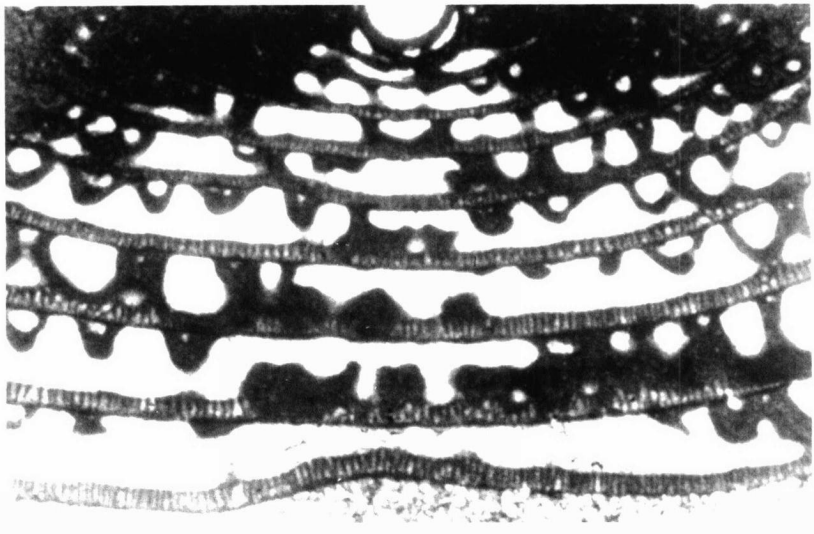

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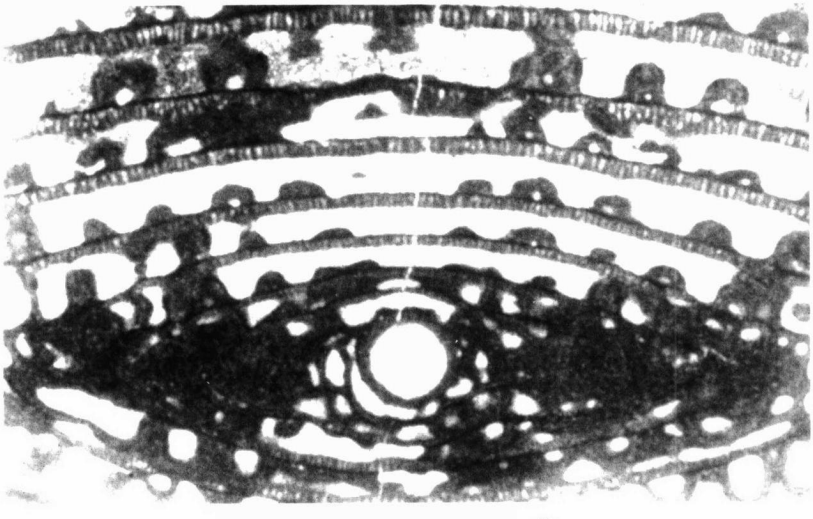

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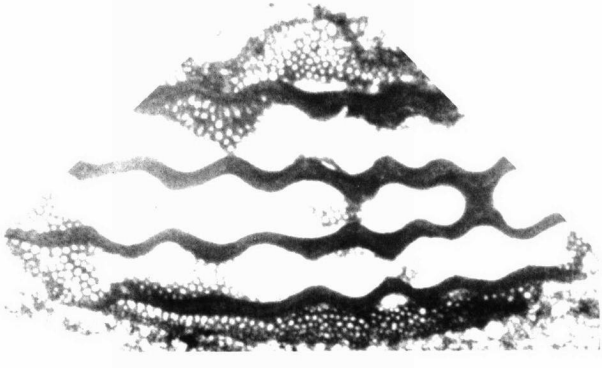

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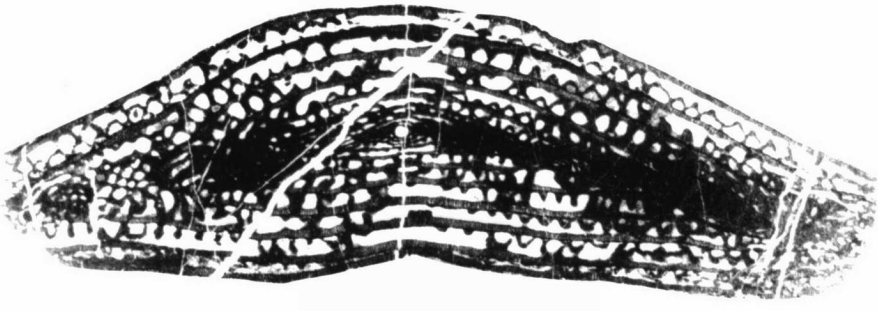

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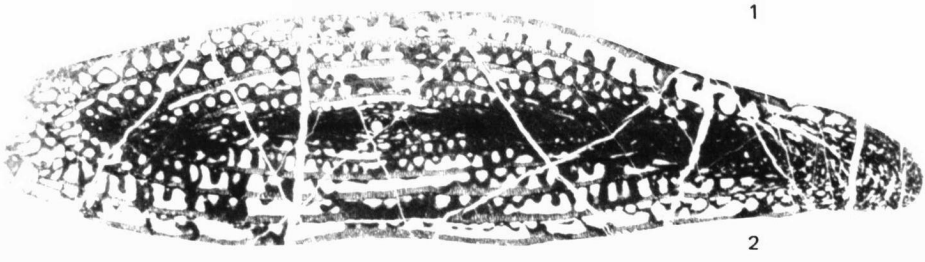

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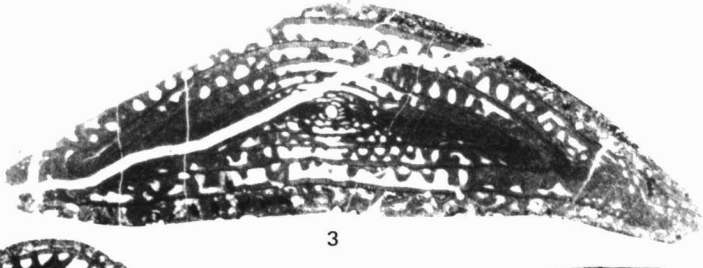

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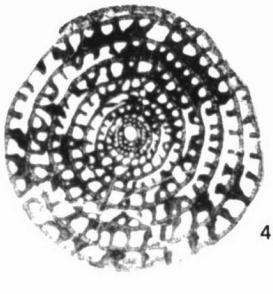

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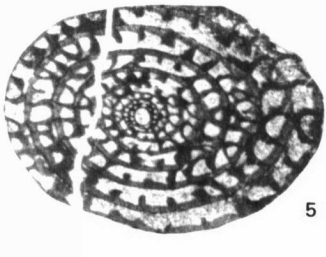

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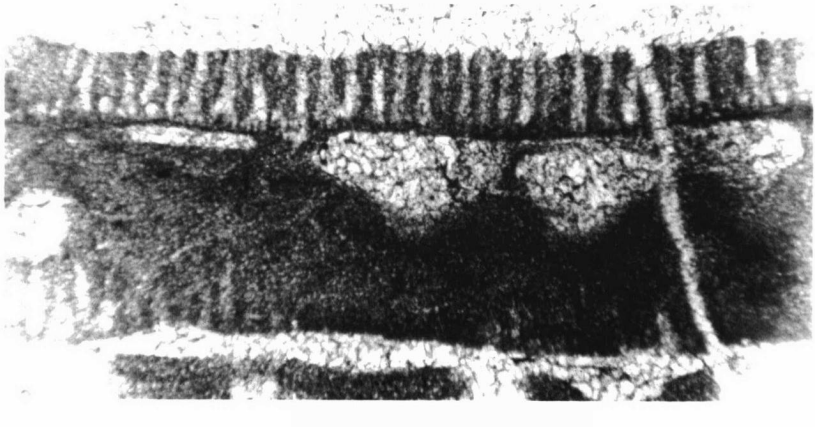

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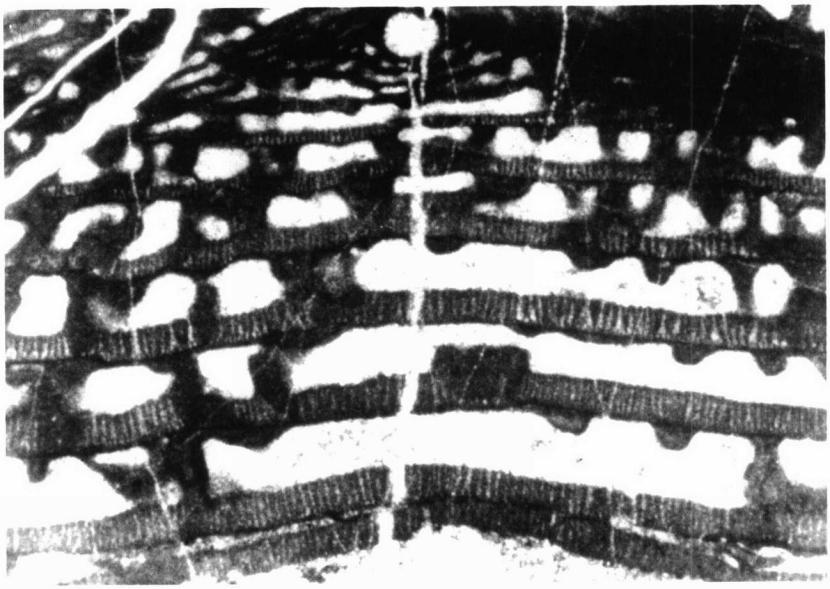

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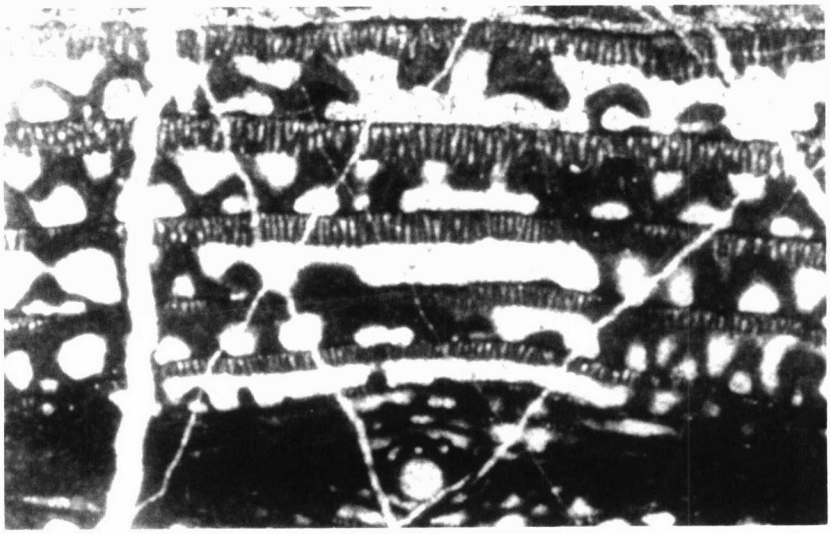

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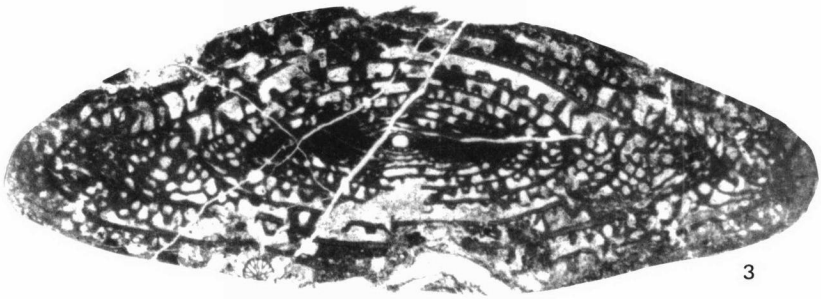

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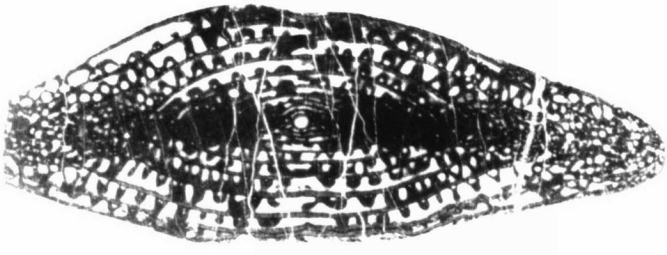

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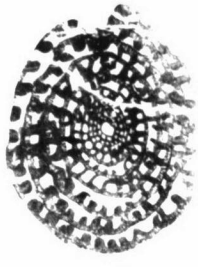

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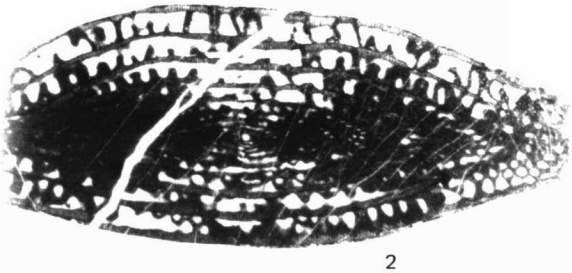

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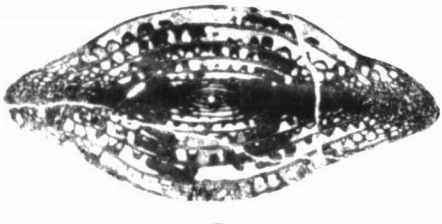

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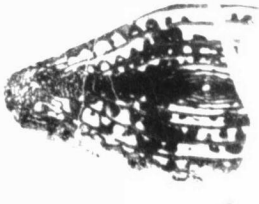

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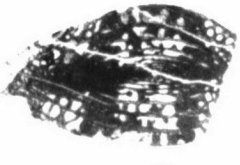

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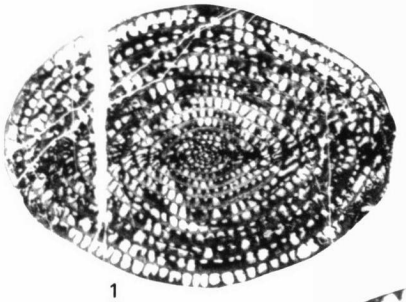

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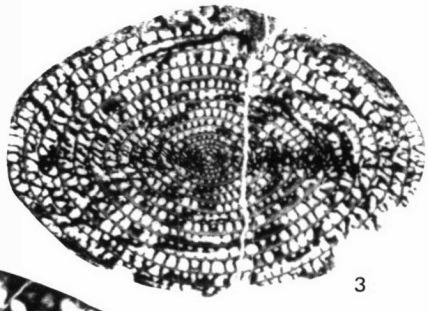

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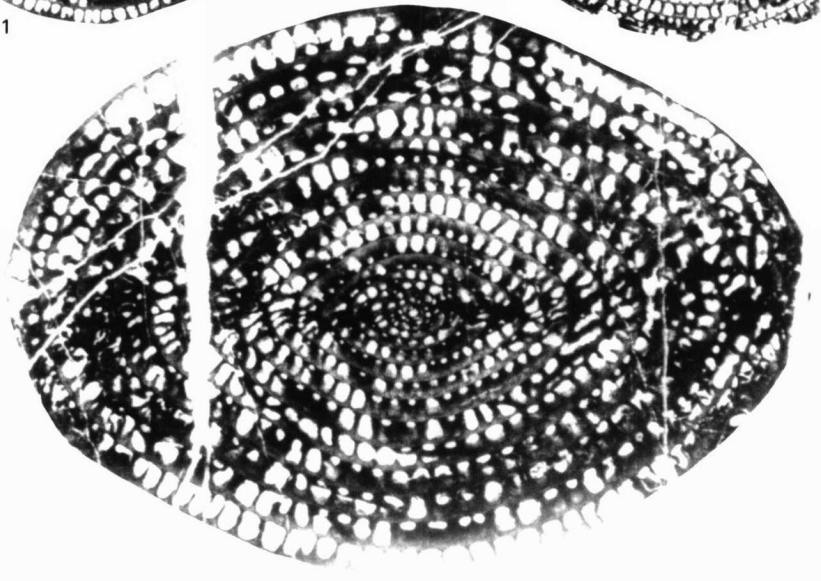

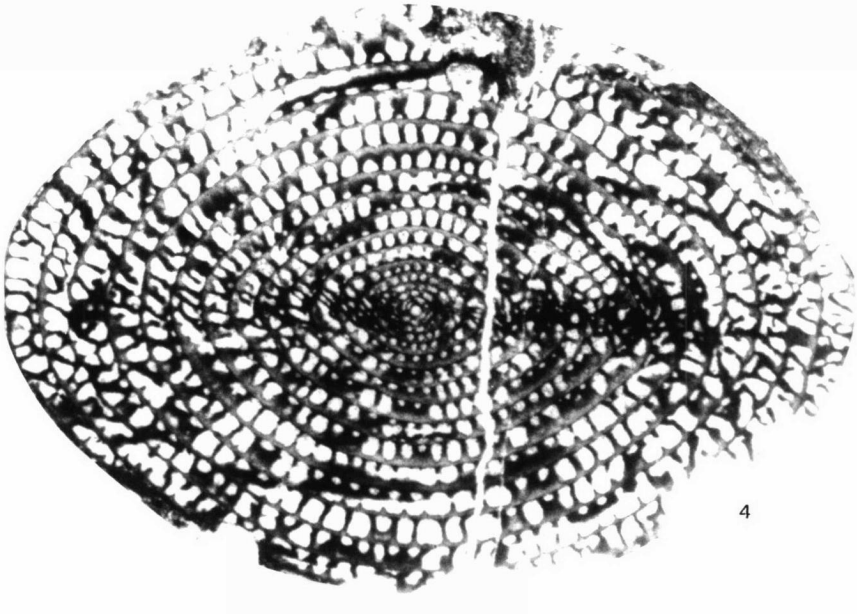

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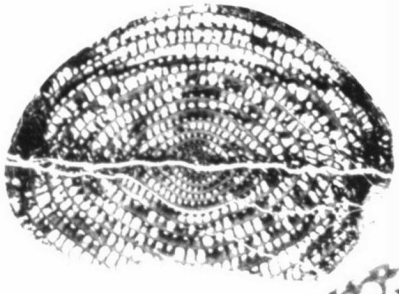

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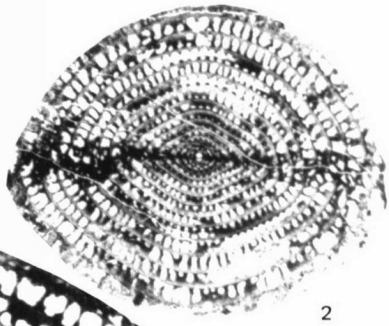

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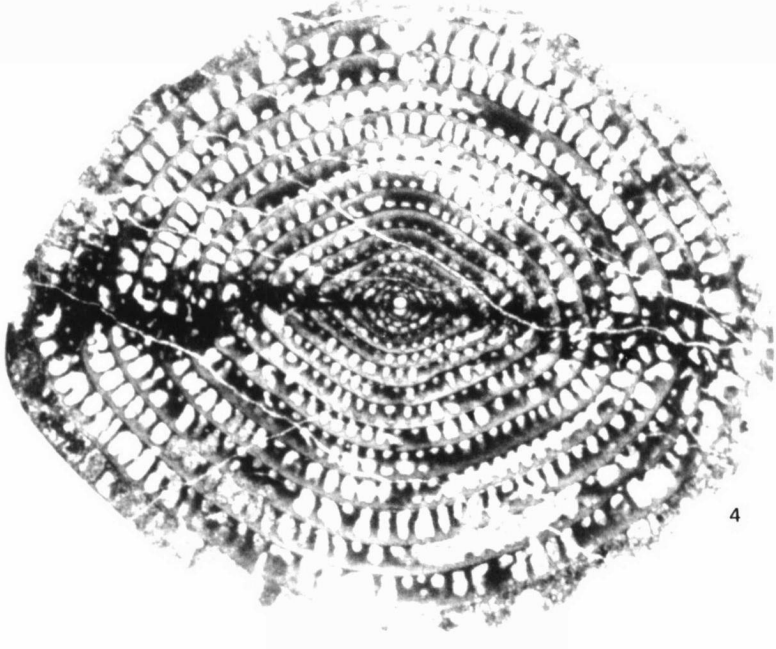

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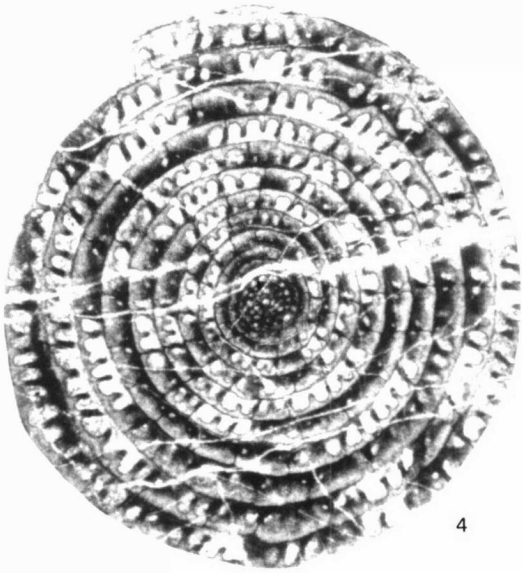

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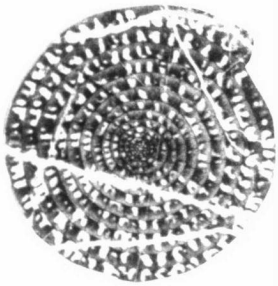

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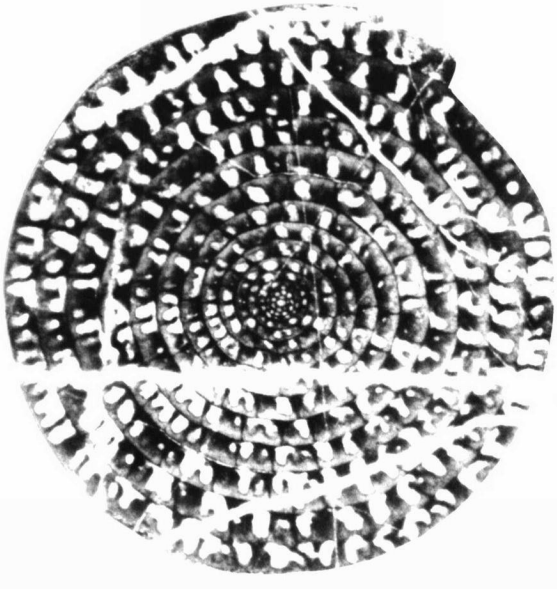

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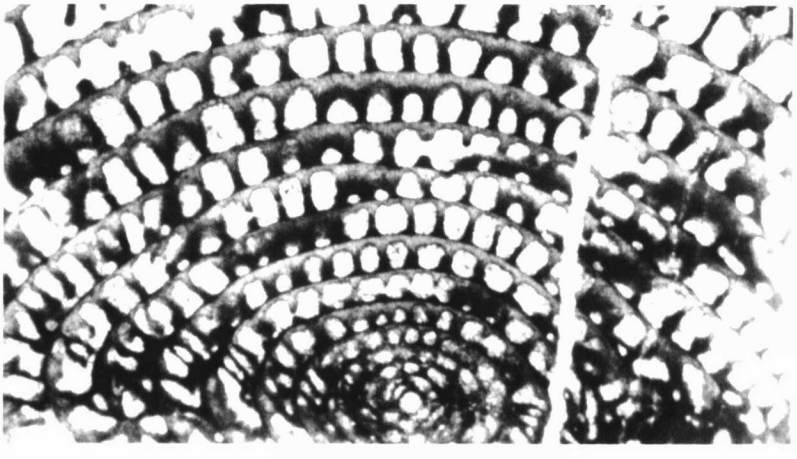

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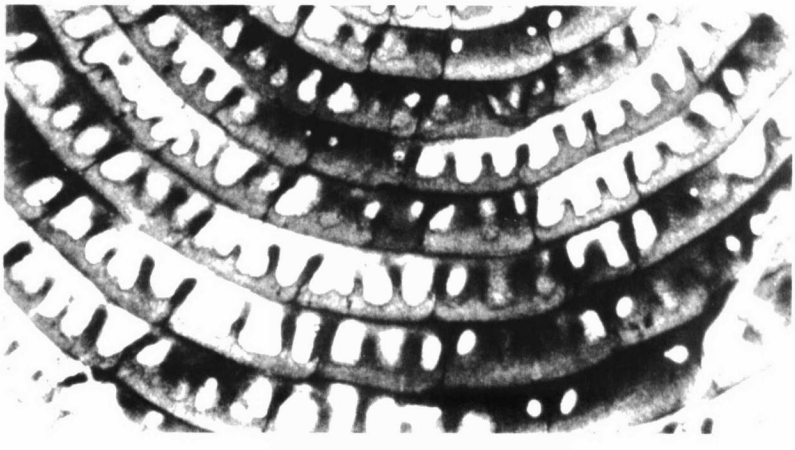

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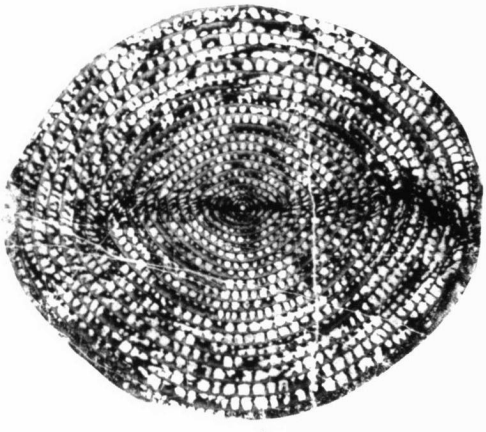

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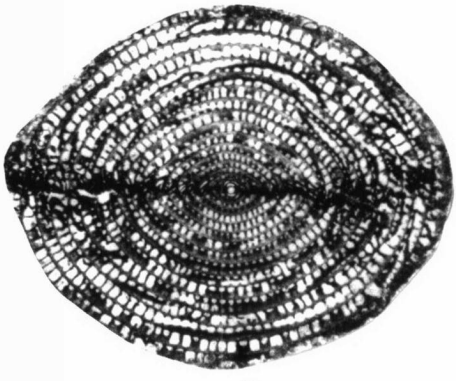

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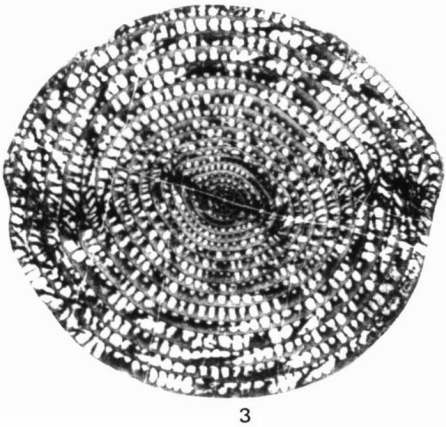

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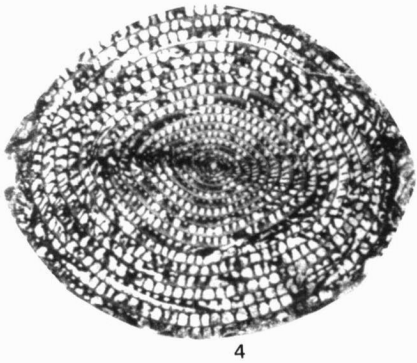

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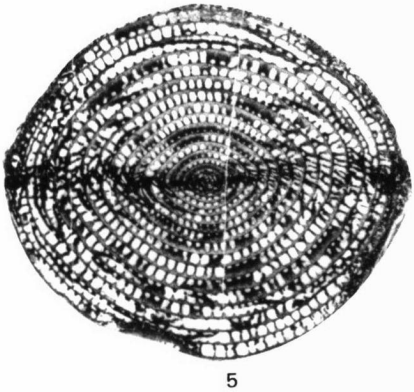

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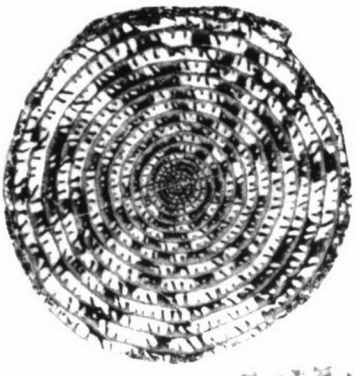

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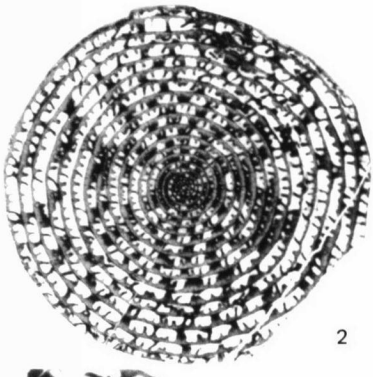

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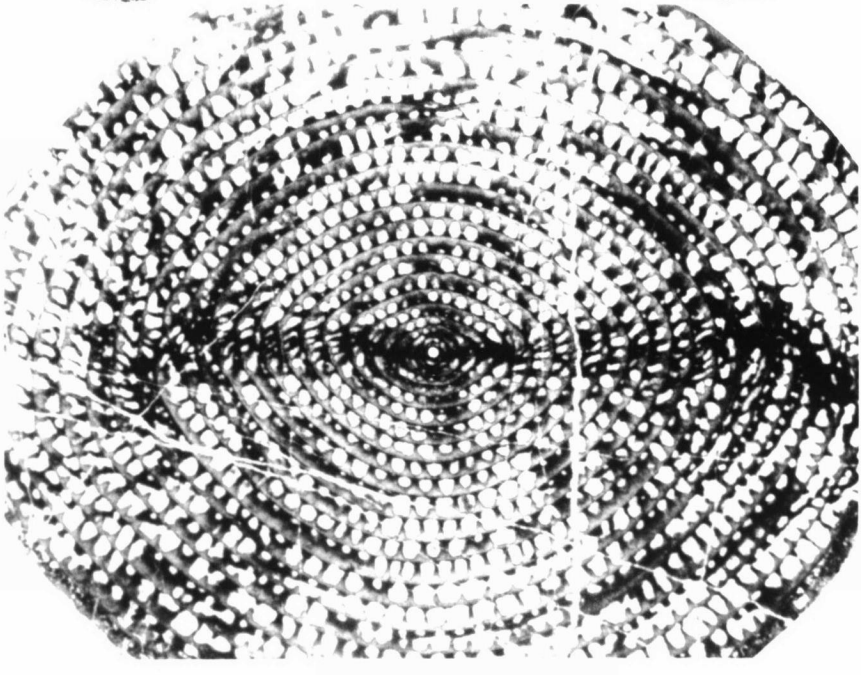

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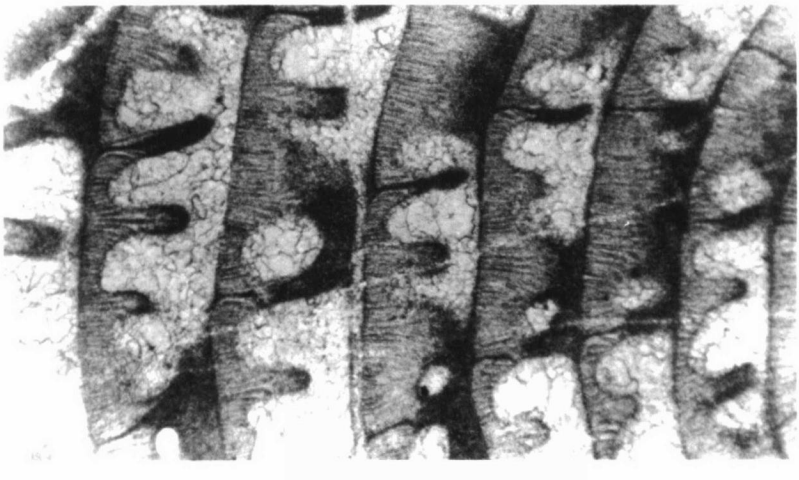

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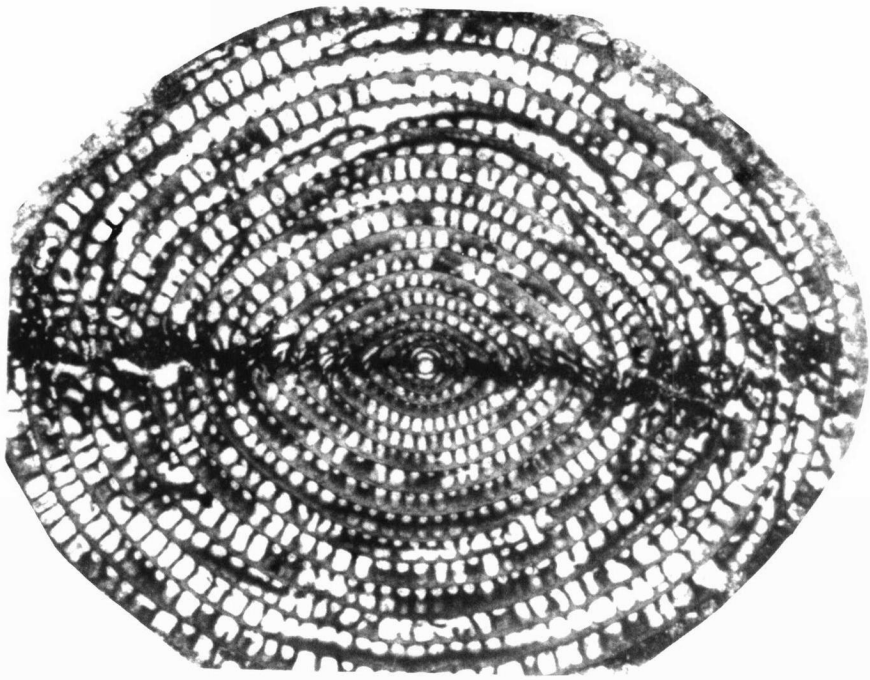

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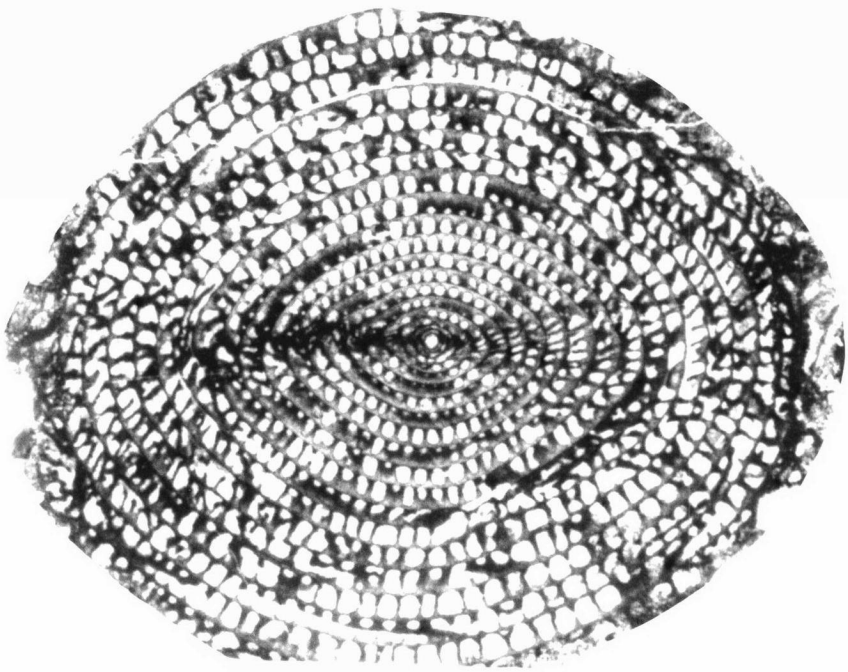

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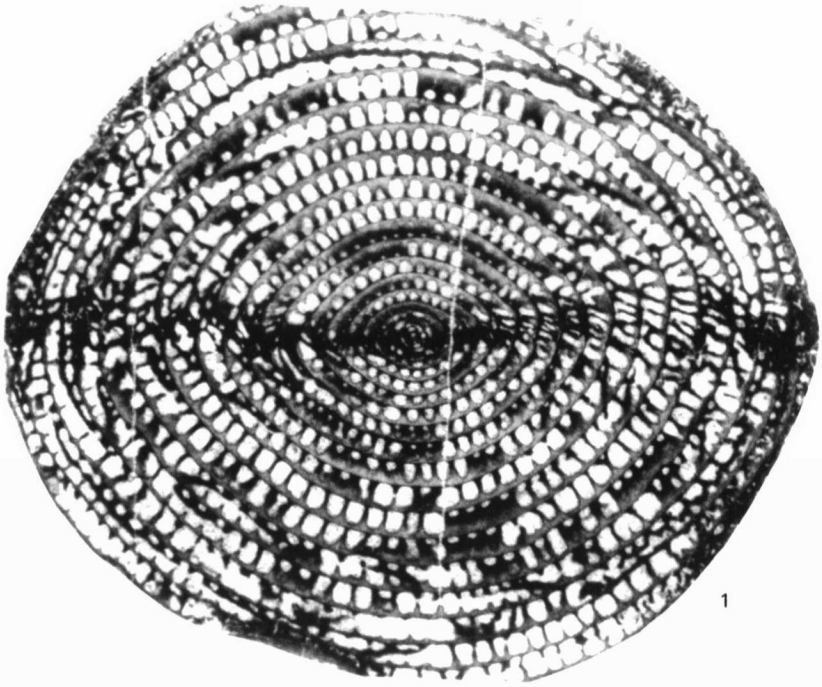

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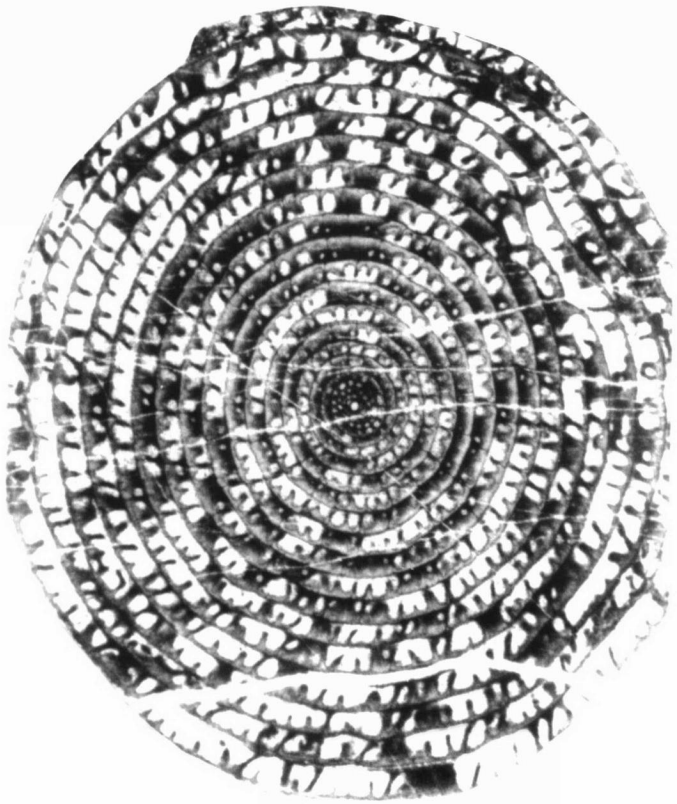

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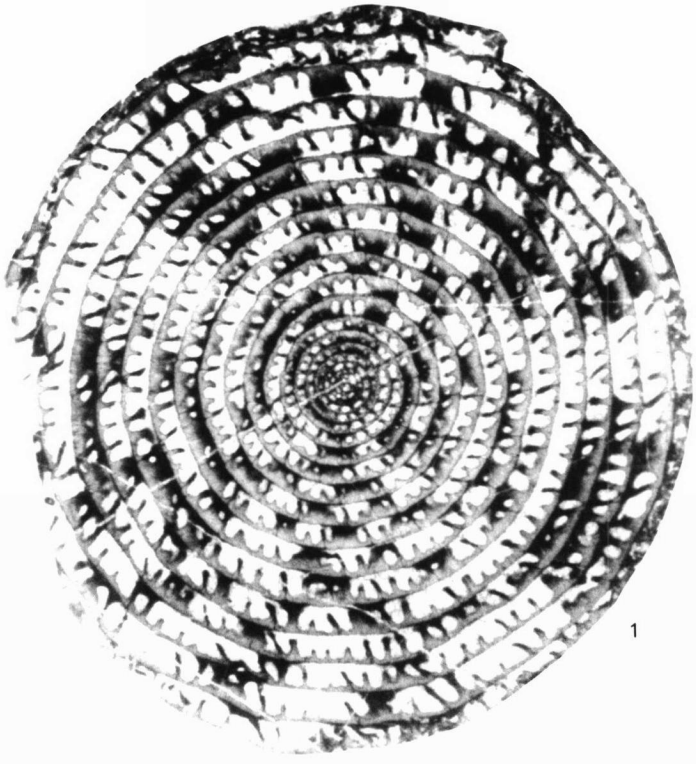

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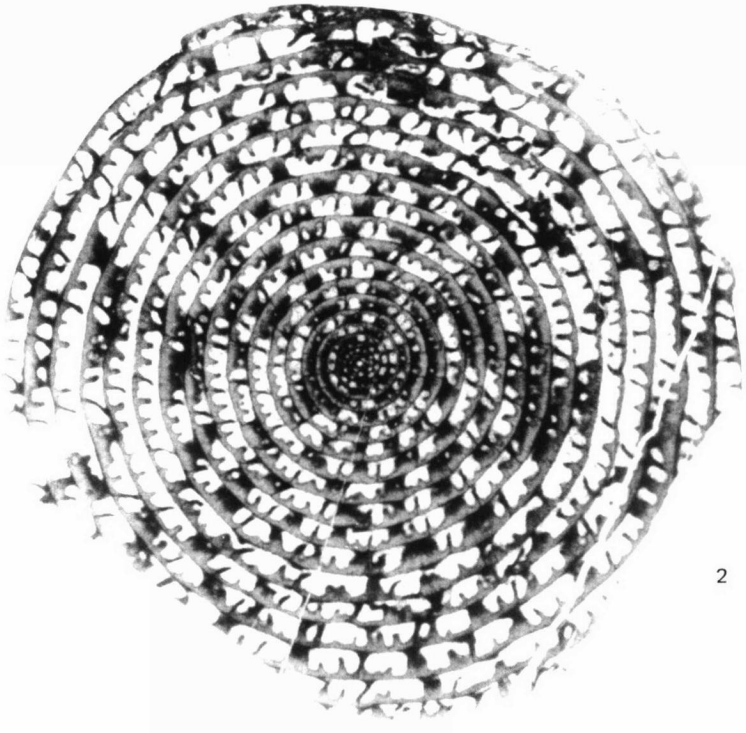

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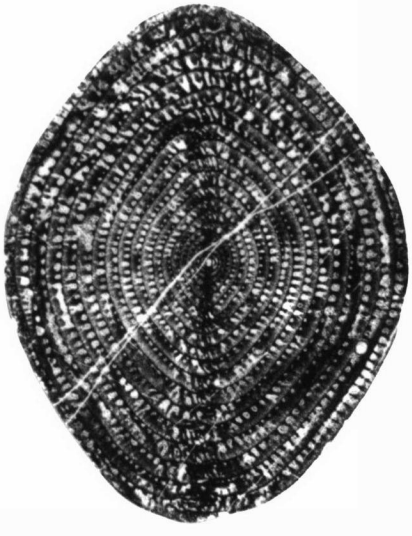

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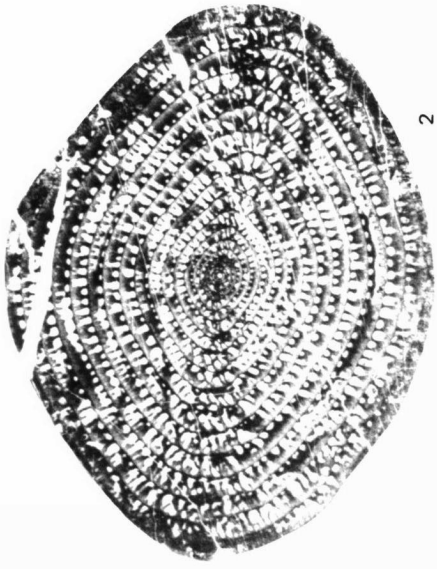

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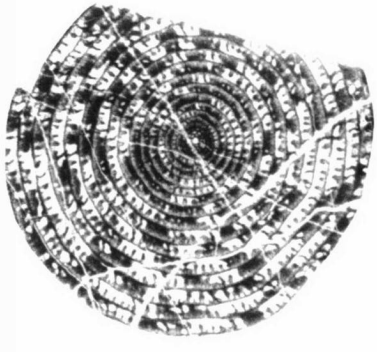

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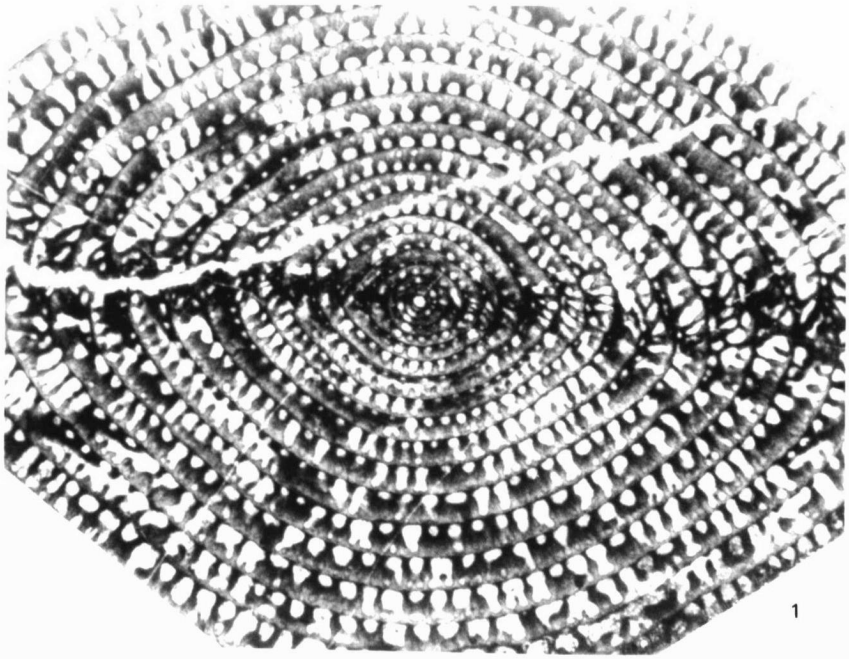

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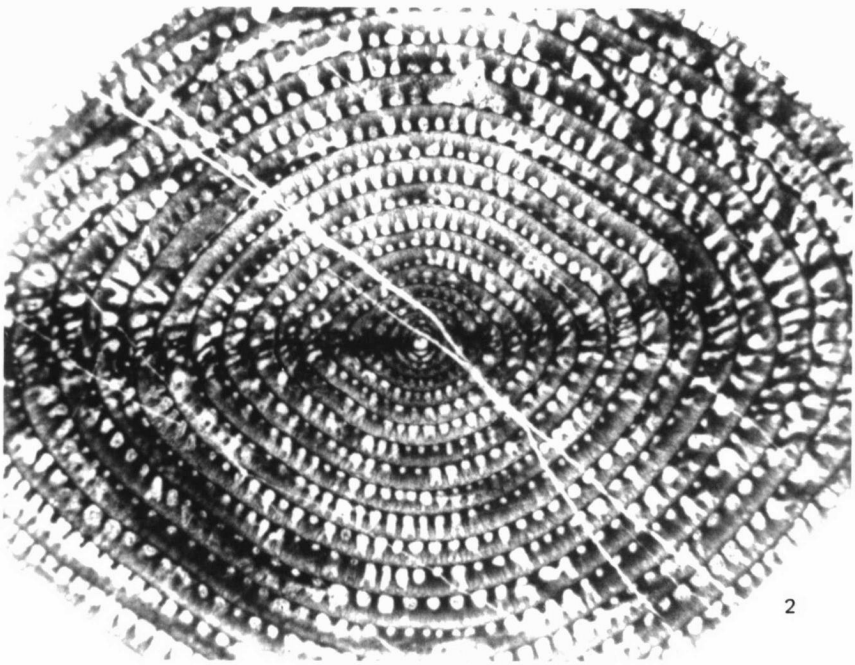

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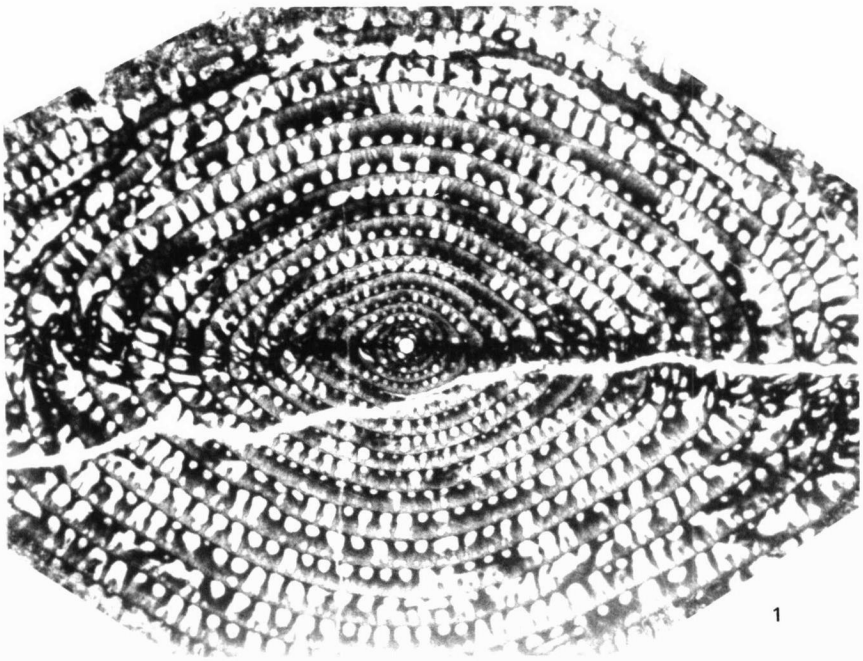

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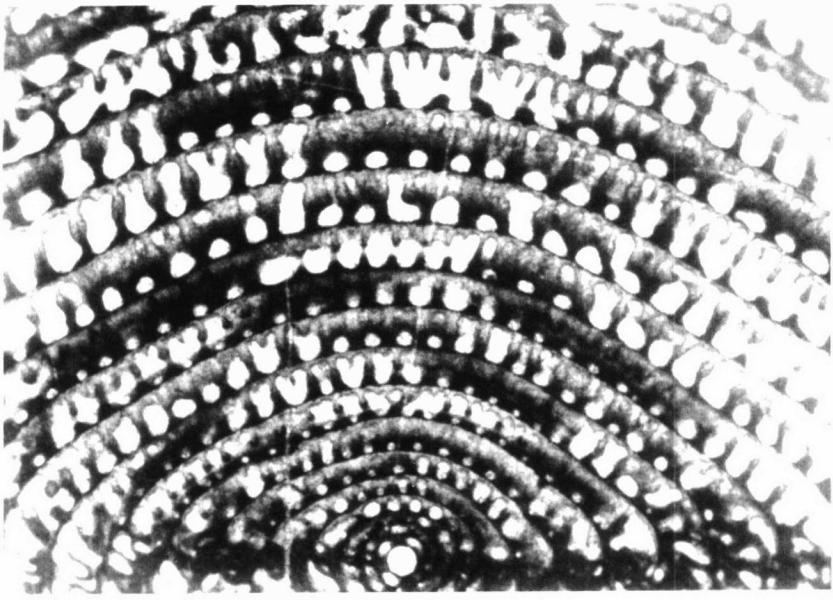

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Illustrations.—Plate 11, figures 4-9; *4-*5, axial section of holotype, ×20, ×40; 6-9, axial secs. of paratypes, ×40. 4-5 from coll. Tur-22; 6 from coll. Tur-28; 7 from coll. Tur-29; 8 from coll. Tur-30; 9 from coll. Tur-21.—— Plate 12, figures 1-4, sagittal secs. of paratypes, ×40. 1 from coll. Tur-21; 2-4 from coll. Tur-7.

Subfamily SCHWAGERININAE Dunbar & Henbest, 1930

Genus SCHWAGERINA von Möller, 1877

SCHWAGERINA SOLITA Skinner, n. sp.

Shell large, slender fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles; mature individuals have 8 to 9.5 volutions, and measure 8.80 to 10.40 mm. in length and 2.60 to 3.00 mm. in diameter; form ratio varies from 2.93 to 3.75, averaging about 3.36.

Spirotheca composed of tectum and coarsely alveolar keriotheca; in 8th whorl it measures 68 to 89 μ in thickness. Septa strongly and regularly fluted throughout shell; septal folds high, commonly extending nearly to tops of chambers; septa number 11 to 13 in 1st volution, 15 to 17 in 2nd, 18 to 20 in 3rd, 19 to 22 in 4th, 20 to 26 in 5th, 21 to 27 in 6th, 25 to 31 in 7th, and 27 to 34 in 8th. Narrow band of secondary material nearly fills shell along axis except in outermost whorls.

Proloculus moderately large, its outside diameter varying from 235 to 317 μ, averaging about 283 μ. Tunnel moderately wide; tunnel angle measures 35° to 42° in 8th volution. Low, narrow, inconspicuous chomata present in early whorls are replaced by pseudochomata in later ones.

Discussion.—Schwagerina solita Skinner, n. sp., generally resembles *S. splendens* Skinner, n. sp., but differs from the latter in its more slender shape, larger form ratio, and somewhat narrower tunnel. It is possible that they may represent 2 subspecies in a single species, but for the present I am treating them as distinct.

Occurrence.—This species is rare in colls. Tur-5, 22, 24, 31, and 32, and abundant in coll. Tur-21.

Illustrations.—Plate 12, figures 5-12; *5. Axial section of the holotype, ×10. 6-8. Axial sections of paratypes, ×10. 9-12. Sagittal sections of paratypes, ×10. 5, 6, 7, 9, 10 from collection Tur-21; 8 from collection Tur-24; 11, 12 from collection Tur-31.

SCHWAGERINA CIRYI Skinner, n. sp.

Shell moderately large, fusiform, with straight to slightly convex lateral slopes and bluntly pointed poles; fully grown individuals have 9 to 10 volutions, and measure 7.70 to 8.35 mm. in length and 3.30 to 3.40 mm. in diameter; form ratio varies from 2.33 to 2.46.

Spirotheca composed of tectum and coarsely alveolar keriotheca; in 8th volution its thickness measures 65 to 81 μ. Septa strongly and regularly folded from pole to pole; septal folds 0.5 to 0.7 as high as chambers; septa number 11 to 13 in 1st whorl, 17 to 18 in 2nd, 18 to 22 in 3rd, 20 to 24 in 4th, 19 to 26 in 5th, 26 to 29 in 6th, 29 to 32 in 7th, 31 to 35 in 8th, and 33 to 35 in 9th. Axial filling, in form of secondary deposit on septa, forms narrow band along axis in all but outermost whorls.

Proloculus moderate in size, its outside diameter varying from 176 to 251 μ, averaging about 216 μ. Tunnel narrow, about 0.5 as high as chambers; tunnel angle in 8th volution measures 27° to 32°. Weak chomata present in early whorls are replaced by pseudochomata in later ones.

Discussion.—Schwagerina ciryi Skinner, n. sp., more nearly resembles *S. splendens* Skinner, n. sp., than any other known species. It differs from the latter in its smaller length, smaller form ratio, and narrower tunnel. It is named for Dr. Raymond Ciry.

Occurrence.—This species is rare in colls. Tur-21 and Tur-27, common in colls. Tur-22, 28, and 29, and abundant in coll. Tur-31.

Illustrations.—Plate 13, figures 1-7; *1, axial sec. of holotype, ×10; 2-4, axial secs. of paratypes, ×10; 5-7, sagittal secs. of paratypes, ×10. 1, 3, 4 from coll. Tur-31; 2, 5 from col. Tur-21; 6 from coll. Tur-22; 7 from coll. Tur-28.

SCHWAGERINA NAVILLEI Erk

Schwagerina navillei Erk, 1942, Inst. Études Rech. Min. Turquie Pub., sér. B, no. 9, p. 251-253, pl. 21, fig. 3-5.

Shell large, elongate fusiform, with nearly straight lateral slopes and bluntly pointed poles; mature individuals have 8.5 to 9.5 volutions, and measure 11.00 to 12.30 mm. in length and 3.70 to 3.90 mm. in diameter; form ratio varies from 2.97 to 3.15.

Spirotheca composed of tectum and coarsely alveolar keriotheca; in 8th volution its thickness measures 79 to 89 μ. Septa strongly but somewhat irregularly folded; septal folds rather low in equatorial region, becoming much higher toward poles; septal pores numerous in polar regions; septa number 10 to 12 in 1st whorl, 18 to 19 in 2nd, 16

to 21 in 3rd, 20 to 25 in 4th, 20 to 26 in 5th, 24 to 27 in 6th, 23 to 30 in 7th, 26 to 37 in 8th, and about 33 in 9th. Narrow band of secondary material coats septa along axis, particularly in early whorls.

Proloculus moderately large, its outside diameter varying from 295 to 370 μ. Tunnel low and moderately wide; in 8th volution tunnel angle measures 40° to 54°. Low, narrow chomata in early whorls are replaced by pseudochomata in later ones.

Discussion.—The above description is based on my own specimens which differ from ERK's type specimens, from the Bursa region of Turkey, in having a somewhat larger proloculus and smaller form ratio. In all other respects, however, the agreement is so close that they are believed to be conspecific.

Occurrence.—*Schwagerina navillei* Erk is rare in coll. Tur-23 and Tur-30, common in coll. Tur-29, and abundant in coll. Tur-31 and Tur-32.

Illustrations.—Plate 13, figure 8, axial sec., ×10. From coll. Tur-31.——Plate 14, figures 1-5; 1-3, axial secs., ×10; 4-5, sagittal secs., ×10. 1-2, 5 from coll. Tur-32; 3-4 from coll. Tur-31.

SCHWAGERINA SPLENDENS Skinner, n. sp.

Shell rather large, fusiform, with nearly straight to convex lateral slopes and bluntly pointed poles; fully grown specimens possess 9 to 10 volutions, and measure 8.60 to 9.80 mm. in length and 2.95 to 3.70 mm. in diameter; form ratio varies from 2.54 to 2.97.

Spirotheca composed of tectum and coarsely alveolar keriotheca (Pl. 16, figs. 1-3); in the eighth whorl its thickness measures 69 to 89 microns. Septa strongly and regularly fluted from pole to pole; septal folds high, commonly reaching tops of chambers; septa number 11 to 12 in 1st volution, 15 to 20 in 2nd, 15 to 21 in 3rd, 17 to 23 in 4th, 23 to 25 in 5th, 29 to 30 in 6th, 25 to 27 in 7th, 27 to 39 in 8th, and 31 to 37 in 9th. Coating of secondary material on septa produces narrow band of filling along axis.

Proloculus moderately large, its outside diameter varying from 232 to 334 μ, averaging about 290 μ. Tunnel moderately wide; in 8th whorl tunnel angle measures 36° to 50°, averaging about 43°. Low, narrow chomata in early volutions are replaced by pseudochomata in later ones.

Discussion.—*Schwagerina splendens* SKINNER, n. sp., resembles *S. solita* SKINNER, n. sp., but differs from the latter in its smaller form ratio and somewhat wider tunnel. As previously stated, it is possible that they may represent subspecies of a single species.

Occurrence.—This species is rare in colls. Tur-21, 26, 27, and 29, and abundant in colls. Tur-30, 31, and 32.

Illustrations.—Plate 15, figures 1-7; *1, axial sec. of holotype, ×10; 2-5, axial secs. of paratypes, ×10; 6-7, sagittal secs. of paratypes, ×10. 1-4, 6 from coll. Tur-31; 5 from coll. Tur-21; 7 from coll. Tur-26.——Plate 16, figures 1-3; 1, part of specimen shown in Pl. 15, fig. 3, illustrating wall structure, ×40; 2, part of axial sec. of paratype, ×40; 3, part of tang. sec., showing coarse alveoli in end-on view, ×40. All from coll. Tur-31.

Genus CHUSENELLA Hsu, 1942

[emend. CHEN, 1956]

CHUSENELLA EXTENSA Skinner, n. sp.

Shell large, elongate fusiform, with strongly curved axis of coiling and bluntly pointed poles; mature specimens have about 9.5 volutions, and measure 13.00 to 13.40 mm. in length and 3.10 to 3.40 mm. in diameter; first 4 whorls tightly coiled with sharply pointed poles, after which coiling becomes looser; form ratio varies from 3.82 to 4.32.

Spirotheca composed of tectum and coarsely alveolar keriotheca (Pl. 17, fig. 6; Pl. 18, figs. 1, 2); thin in early volutions, and thickening rather abruptly at about beginning of 5th whorl; in 8th volution it measures 101 to 127 μ in thickness. Septa nearly plane in tightly coiled early volutions, becoming strongly fluted in more loosely coiled ones; septal folds high, commonly reaching tops of chambers; septa number 12 to 13 in 1st whorl, 18 to 20 in 2nd, 17 to 20 in 3rd, 21 to 22 in 4th, 21 to 24 in 5th, 25 to 30 in 6th, 30 to 34 in 7th, 30 to 41 in 8th, and about 39 in 9th. Axial filling, consisting of secondary deposits on septa, nearly fills axial zone except in outermost whorls.

Proloculus moderate in size, its outside diameter varying from 166 to 265 μ, averaging about 203 μ. Tunnel moderately wide; in 8th volution tunnel angle measures 37° to 45°. Low, narrow chomata present except in outermost whorls.

Discussion.—*Chusenella extensa* SKINNER, n. sp., more nearly resembles *C. ciboloensis* STEWART than any other described species. It differs from the latter in its larger size, smaller form ratio, and larger proloculus.

Occurrence.—This species is rare in coll. Tur-21, and common in colls. Tur-7, 20, 25, 26, and 27.

Illustrations.—Plate 17, figures 1-6; *1, axial sec. of holotype, ×10; 2, axial sec. of paratype, ×10; 3, axial sec. of immature paratype, ×10; 4-5, sagittal secs. of paratypes, ×10; 6, part of specimen shown in fig. 2, illustrating wall structure, ×100. 1-2, 4, 6 from coll. Tur-26; 3 from coll. Tur-21; 5 from coll. Tur-7.——Plate 18, figures 1-2; *1, part of holotype, ×40; 2, part of specimen shown in Pl. 17, fig. 2, ×40. Both from coll. Tur-26.

CHUSENELLA SOLIDA Skinner, n. sp.

Shell large, body of shell thickly subcylindrical with conical, bluntly pointed polar extremities; fully grown individuals have 9 to 10 volutions, and measure 9.00 to 10.90 mm. in length and 3.10 to 3.85 mm. in diameter; first 4 to 5 whorls constitute tightly coiled juvenarium, followed by more loosely coiled adult stage; form ratio varies from 2.83 to 3.03.

Spirotheca composed of tectum and coarsely alveolar keriotheca; thin in tightly coiled juvenarium, abruptly thickening at beginning of adult stage; in 8th whorl its thickness measures 75 to 92 μ. Septa nearly plane in juvenarium, becoming strongly but irregularly fluted in adult stage; septal folds narrow and high, commonly reaching tops of chambers; septa number about 11 in 1st volution, 15 in 2nd, 18 in 3rd, 20 in 4th, 23 in 5th, 24 in 6th, 27 in 7th, 30 in 8th, and 33 in 9th. Axial filling strongly developed, nearly filling juvenarium and occupying irregular zone in adult whorls midway between tunnel and poles.

Proloculus moderate in size, its outside diameter ranging from 151 to 278 μ, averaging about 210 μ. Tunnel narrow; in the eighth volution tunnel angle measures 24 to 32 degrees. Low, narrow chomata present in tightly coiled whorls replaced by pseudochomata in later ones.

Discussion.—*Chusenella solida* Skinner, n. sp., does not closely resemble any previously described species.

Occurrence.—This species is common in colls. Tur-21, 25, and 26.

Illustrations.—Plate 18, figure *3; axial sec. of holotype, ×10. From coll. Tur-21.——Plate 19, figures 1-4; 1-3, axial secs. of paratypes, ×10; 4, sagittal sec. of paratype, ×10. 1, 2 from coll. Tur-26; 3, 4 from coll. Tur-25.

CHUSENELLA MINUTA Skinner, n. sp.

Shell small, thickly fusiform, with straight to slightly concave lateral slopes and bluntly pointed poles; mature specimens have 9.5 to 10 volutions, and measure 4.03 to 5.96 mm. in length and 1.90 to 2.61 mm. in diameter; the first 4.5 to 5 whorls constitute tightly coiled juvenarium which is followed by more loosely coiled adult stage; form ratio varies from 2.12 to 2.48.

Spirotheca composed of tectum and coarsely alveolar keriotheca; thin, with obscure structure, in tightly coiled juvenarium, becoming somewhat thicker, with distinct structure at beginning of adult stage; in 8th volution its thickness measures 49 to 65 μ. Septa essentially plane in juvenarium, becoming strongly and regularly folded in more loosely coiled portion; septal loops 0.5 to 0.7 as high as chambers; secondary deposits on septa fill narrow band along axis and narrow zone on either side of tunnel, producing distinctive pattern as seen in axial sections; this causes tops of septal loops in affected areas to be greatly thickened; septa number 11 to 14 in 1st volution, 14 to 15 in 2nd, 15 to 16 in 3rd, 16 to 18 in 4th, 19 to 21 in 5th, 20 to 21 in 6th, 25 to 26 in 7th, and about 27 in 8th.

Proloculus small, its outside diameter measuring 108 to 148 μ. Tunnel narrow; in 8th volution tunnel angle measures 18° to 27°. Low, narrow chomata in juvenarium replaced by pseudochomata in adult stage.

Discussion.—*Chusenella minuta* Skinner, n. sp., is similar to *C. tingi* Chen, but is distinguished from that species by its somewhat larger size and the distinctive distribution of its axial filling.

Occurrence.—This species is rare in colls. Tur-19, 29, and 30, and common in colls. Tur-24 and Tur-27.

Illustrations.—Plate 19, figures 5-9; *5, axial sec. of holotype, ×10; 6-7, axial secs. of paratypes, ×10; 8-9, sagittal secs. of paratypes, ×10. 5, 7 from coll. Tur-27; 6, 8 from coll. Tur-24; 9 from coll. Tur-19.

Family VERBEEKINIDAE von Staff & Wedekind, 1910

[*nom. transl.* A. D. Miklukho-Maklay, 1957, p. 110 (*ex* Verbeekininae von Staff & Wedekind, 1910, p. 114)]
[=Neoschwagerinidae Dunbar & Condra, 1927 (1928), p. 74 (*nom. transl.* Dunbar, 1948, p. 164 (*ex* Neoschwagerininae Dunbar & Condra, 1928)]

Subfamily NEOSCHWAGERININAE Dunbar & Condra, 1927 (1928)

Genus NEOSCHWAGERINA Yabe, 1903

NEOSCHWAGERINA VENTRICOSA Skinner, n. sp.

Shell small, inflated ellipsoidal, with strongly convex lateral slopes and bluntly pointed poles; mature individuals have 15.5 to 17 volutions, and

measure 5.10 to 5.60 mm. in length and 3.75 to 4.20 mm. in diameter; form ratio varies from 1.21 to 1.47.

Spirotheca composed of tectum and finely alveolar keriotheca; in 14th whorl its thickness measures 30 to 45 μ. Septa plane and rather widely spaced, increasing in number very slowly from whorl to whorl; they number 5 to 7 in 1st volution, 8 to 10 in 2nd, 10 to 13 in 3rd, 11 to 14 in 4th, 13 to 15 in 5th; 13 to 15 in 6th, 15 to 16 in 7th, 14 to 18 in 8th, 16 to 17 in 9th; 18 to 19 in 10th; 19 to 22 in 11th, 19 to 22 in 12th, 17 to 23 in 13th, 19 to 26 in 14th, about 22 in 15th, 24 in 16th, and 24 in 17th. Axial septula, consisting of ribbon-like prolongations of keriotheca intercalated between adjacent septa, first appear in 5th volution with maximum of 1 per chamber in 5th to 7th whorls, 2 in 8th, 3 in 9th to 13th, 4 in 14th to 16th, and 5 in 17th. (These are maxima, and many chambers in the outer whorls have fewer septula.)

Proloculus minute, its outside diameter varying from 53 to 101 μ, averaging about 75 μ. Row of elliptical foramina pierces basal margin of each septum from pole to pole; these alternate with low, narrow parachomata which first appear in 2nd whorl and number 1 in 2nd volution, 4 to 5 in 3rd, 5 to 7 in 4th, 6 to 10 in 5th, 9 to 11 in 6th, 12 to 14 in 7th, 14 to 16 in 8th, 17 to 20 in 9th, 20 to 24 in 10th, 23 to 31 in 11th, 28 to 33 in 12th, 30 to 36 in 13th, 35 to 38 in 14th, 38 to 42 in 15th, and 39 to 43 in 16th. A primary transverse septulum, formed in same manner as axial septula, is positioned immediately above each parachoma; basal margins of septula joined to tops of parachomata to form partitions which divide meridional chambers into rectangular chamberlets; rounded lateral foramina pierce these partitions just in front of and behind each septum to provide lateral communication within shell. No secondary transverse septula observed.

Discussion.—Neoschwagerina ventricosa Skinner, n. sp., resembles *N. tebagaensis* Skinner & Wilde, but differs from that species in its larger size for the same number of whorls, larger form ratio, and the later appearance and smaller number of its axial septula. In addition, *N. tebagaensis* has incipient secondary transverse septula in the outermost whorls, whereas none has been observed in *N. ventricosa*. It also resembles *N. pinguis* Skinner, n. sp., but differs from that species in its smaller size, fewer whorls, larger form ratio, and thicker spirotheca.

Occurrence.—This species is common in colls. Tur-17 and Tur-20, and abundant in colls. Tur-5, 7, and 19.

Illustrations.—Plate 20, figures 1-4; *1-*2, axial sec. of holotype, ×10, ×20; 3-4, axial sec. of paratype, ×10, ×20. Both from coll. Tur-5.——Plate 21, figures 1-4; 1-2, axial secs. of paratypes, ×10; 3-4, same specimens, ×20. 1, 3 from coll. Tur-5; 2, 4 from coll. Tur-7.——Plate 22, figures 1-5; 1-2, sagittal secs. of paratypes, ×10; 3-4, same specimens, ×20; 5, sagittal sec. of paratype, ×10. 1, 3, 5 from coll. Tur-7; 2, 4 from coll. Tur-17.——Plate 23, figures 1-3; 1, specimen shown in Pl. 22, fig. 5, ×20; 2, part of specimen shown in Pl. 20, fig. 2, ×40, to show character of transverse septula; 3, part of specimen shown in Pl. 22, fig. 1, ×40, to show character of axial septula. 1, 3 from coll. Tur-7; 2 from coll. Tur-5.

NEOSCHWAGERINA PINGUIS Skinner, n. sp.

Shell small, subglobular, with strongly convex lateral slopes and bluntly rounded poles; fully grown individuals have 18.5 to 20.5 volutions, exceptionally 23.5, and measure 5.50 to 6.45 mm. in length and 4.55 to 5.55 mm. in diameter; form ratio varies from 1.11 to 1.23. First 2 whorls commonly coiled askew to later ones.

Spirotheca composed of tectum and finely alveolar keriotheca (Pl. 25, fig. 4); its thickness measures 19 to 30 μ in 14th whorl, 22 to 30 μ in 15th, 23 to 29 μ in 16th, and 23 to 33 μ in 17th. Septa plane and rather widely spaced, increasing in number slowly from volution to volution; they number 11 to 12 in 3rd whorl, 11 to 14 in 4th, 13 to 15 in 5th, 14 to 16 in 6th, 15 to 16 in 7th, 15 to 17 in 8th, 15 to 18 in 9th, 15 to 19 in 10th, 18 to 19 in 11th, 19 to 21 in 12th, 20 to 22 in 13th, 18 to 24 in 14th, 19 to 23 in 15th, 20 to 23 in 16th, 22 to 26 in 17th, 18 to 24 in 18th, 20 to 26 in 19th, and 22 to 25 in 20th. Axial septula, consisting of ribbon-like prolongations of keriotheca (Pl. 25, fig. 4), intercalated between adjacent septa; they first appear in 5th volution with a maximum of 1 per chamber in 5th to 7th whorls, 2 in 8th and 9th, 3 in 10th to 12th, 4 in 13th to 16th, and 5 from 17th outward. (These are maxima, and many chambers in outer whorls have smaller number.)

Proloculus minute, its outside diameter varying from 61 to 112 μ, averaging about 80 μ. Row of elliptical foramina is located along base of each septum from pole to pole; they alternate with low, narrow parachomata which first appear in 2nd volution and number 2 to 3 in 2nd whorl, 3 to 5 in

3rd, 5 to 7 in 4th, 8 to 9 in 5th, 9 to 12 in 6th, 12 to 16 in 7th, 14 to 18 in 8th, 16 to 22 in 9th, 20 to 25 in 10th, 20 to 26 in 11th, 24 to 31 in 12th, 25 to 37 in 13th, 28 to 37 in 14th, 32 to 40 in 15th, 35 to 46 in 16th, 36 to 47 in 17th, 42 to 49 in 18th, 42 to 52 in 19th, 42 to 48 in 20th, 48 in 21st, 53 in 22nd, and 59 in 23rd. Primary transverse septulum, formed in same manner as axial septula, is located immediately above each parachoma; basal margins of septula are joined to tops of parachomata to form partitions which divide meridional chambers into rectangular chamberlets; rounded lateral foramina, located just in front of and behind each septum, penetrate these partitions to provide lateral communication within shell. No secondary transverse septula observed.

Discussion.—*Neoschwagerina pinguis* SKINNER, n. sp., is similar to *N. ventricosa* SKINNER, n. sp., but differs from that species in its larger size, more numerous volutions, smaller form ratio, and thinner spirotheca. It also resembles *N. glintzboeckeli* SKINNER & WILDE, but may be distinguished from the latter by its smaller size, more numerous whorls, and less numerous axial septula.

Occurrence.—This species occurs questionably in coll. Tur-18, but it is abundant in colls. Tur-19 through Tur-32.

Illustrations.—Plate 24, figures 1-6; *1, axial sec. of holotype, ×10; 2-5, axial secs. of paratypes, ×10; 6, sagittal sec. of paratype, ×10. 1, 3, 6 from coll. Tur-25; 2, 4 from coll. Tur-21; 5 from coll. Tur-27.——Plate 25, figures 1-4; 1-2, sagittal secs. of paratypes, ×10; *3, axial sec. of holotype, ×20; 4, part of specimen shown in fig. 1, ×100, to show wall structure. 1, 3, 4 from coll. Tur-25; 2 from coll. Tur-26.——Plate 26, figures 1-2; 1, specimen shown in Pl. 24, fig. 2, ×20; 2, specimen shown in Pl. 24, fig. 4, ×20. Both from coll. Tur-21.——Plate 27, figures 1-2; 1, specimen shown in Pl. 24, fig. 5, ×20; 2, specimen shown in Pl. 24, fig. 6, ×20. 1 from coll. Tur-27; 2 from coll. Tur-25.——Plate 28, figures 1-2; 1, specimen shown in Pl. 25, fig. 1, ×20; 2, specimen shown in Pl. 25, fig. 2, ×20. 1 from coll. Tur-25; 2 from coll. Tur-26.

Genus YABEINA Deprat, 1914

YABEINA OPIMA Skinner, n. sp.

Shell moderately large, inflated fusiform to subglobular, with convex lateral slopes and bluntly rounded poles; mature individuals have 18 to 21.5 volutions, exceptionally 24, and measure 6.95 to 7.60 mm. in length and 4.90 to 6.70 mm. in diameter; form ratio varies from 1.13 to 1.47.

Spirotheca composed of tectum and finely alveolar keriotheca; its thickness measures 17 to 22 μ in 14th whorl, 19 to 23 μ in 15th, 17 to 23 μ in 16th, and 17 to 22 μ in 17th. Septa plane and widely spaced, numbering 8 in 1st volution, 11 in 2nd, 12 to 15 in 3rd, 13 to 16 in 4th, 16 in 5th, 13 to 14 in 6th, 14 to 16 in 7th, 16 in 8th, 15 to 19 in 9th, 14 to 17 in 10th, 13 to 18 in 11th, 14 to 18 in 12th, 17 to 20 in 13th, 18 to 19 in 14th, 18 to 20 in 15th, about 20 in 16th, 22 in 17th, 21 in 18th, 23 in 19th, 20 in 20th, and 21 in 21st. Axial septula, composed of ribbon-like extensions of part of keriotheca, commonly are consolidated at tips by plugging of constituent alveoli with secondary material; they first appear in 5th volution with a maximum of 1 per chamber in that whorl, 2 in 6th and 7th, 3 in 8th and 9th, 4 in 10th, 5 in 11th and 12th, 6 in 13th, 7 in 14th through 18th, 8 in 19th and 20th, and 9 in 21st. (These are maximum figures, and smaller numbers are commonly present in many chambers of outer whorls.)

Proloculus small, its outside diameter ranging from 78 to 125 μ. Row of elliptical foramina is present along basal margin of each septum from pole to pole; these alternate with low, narrow parachomata which are lacking in 1st volution, but number 2 to 4 in 2nd, 4 to 6 in 3rd, 6 to 7 in 4th, 8 to 10 in 5th, 10 to 13 in 6th, 13 to 16 in 7th, 13 to 20 in 8th, 17 to 23 in 9th, 20 to 26 in 10th, 24 to 31 in 11th, 27 to 34 in 12th, 27 to 37 in 13th, 29 to 42 in 14th, 30 to 43 in 15th, 31 to 47 in 16th, 38 to 49 in 17th, 41 to 51 in 18th, 42 to 51 in 19th, about 45 in 20th, and 49 in 21st. A primary transverse septulum is located immediately above each parachoma, and basal margins of septula join tops of parachomata to form partitions which divide meridional chambers into rectangular chamberlets; lateral foramina pierce these partitions just in front of and behind each septum to provide lateral communication within shell. Shorter secondary transverse septula, intercalated between adjacent primary septula, first appear in 6th volution; commonly only 1 such secondary septulum is present between pairs of primary septula until 15th volution is reached, although rarely a second may appear as early as 13th whorl; from 15th volution outward 1 or 2 per pair of primary septula are about equally common; both primary and secondary transverse septula, like axial septula, are composed of elongated alveoli of keriotheca.

Discussion.—*Yabeina opima* SKINNER, n. sp., resembles *Y. punica* (DOUVILLÉ), but differs from that species in somewhat smaller size, later appearance of axial septula, and less numerous parachomata.

Occurrence.—This species is rare in colls. Tur-19, 20, 21, 23, 24, 26, 27, 28, and 31; it is common in coll. Tur-30.

Illustrations.—Plate 29, figures 1-4; *1, axial sec. of holotype, ×10; 2-4, axial secs. of paratypes, ×10. 1, 4 from coll. Tur-21; 2 from coll. Tur-27; 3 from coll. Tur-26. ——Plate 30, figures 1-4; 1-2, axial secs. of paratypes, ×10; 3, sagittal sec. of immature paratype, ×10; 4, slightly oblique sagittal sec. of paratype, ×10. 1, 3 from coll. Tur-19; 2 from coll. Tur-21; 4 from coll. Tur-20. ——Plate 31, figures 1-2; *1, axial sec. of holotype, ×20; 2, specimen shown in Pl. 29, fig. 2, ×20. 1 from coll. Tur-21; 2 from coll. Tur-27.——Plate 32, figures 1-2, specimen shown in Pl. 29, fig. 4, ×20, ×40, to indicate character of transverse septula. From coll. Tur-21.

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